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PART I

Taxonomic And Distributional Studies Of
The New World Cypresses

by

CARL B. WOLF

INTRODUCTION

This part of this paper on the New World cypresses is primarily a descriptive account of the botanical and distributional features of the group. Without it the other two parts would be rather meaningless because of an inability to use the botanical names which have been applied in the past with any degree of assurance that they had any stability. If there be any doubt as to the difficulties along this line, I suggest that the reader delve into the botanical confusion which has grown up in botanical literature regarding *Cupressus Goveniana*, a species which has often included material here regarded as belonging to four other species. In addition to these variable and confusing usages of names, there has also been a rather imposing list of published names which oftentimes were based on a single unusual collection or variant in horticulture. To evaluate these names properly has been far more of a problem because it has been impossible to see either the living or preserved material on which most of them were based.

If this botanical treatment of the New World cypresses has any merit it is primarily because I have been afforded opportunities for first-hand studies of the living plants which no other botanist has ever had, and which I feel have enabled me to arrive at a reasonably fair evaluation of the natural units within the genus which deserve nomenclatorial recognition. Fortunately, these studies have not resulted in a great deal of shifting of names, and even though I have proposed three new entities for consideration, I do not feel that they are primarily important because they bear new names, but only because they serve partially to complete the picture as to what units comprise the genus in the New World.

My taxonomic viewpoint needs no elucidation on my part, other than to suggest that it is best determined by critically examining the botanical treatment presented in the following pages and by testing it by means of the living plants as they occur in nature.

Perhaps a word of explanation should be given as to certain abbreviations used in this paper. It is the practice at the Rancho Santa Ana Botanic Garden to give each collection in the wild a Collection Number (abbreviated here as Coll. No.). To seed or other propagation material taken with the above is assigned a Propagation Number (Prop. No.) under which this given lot is grown in the Garden. The abbreviation "Neg. No." refers to the photographic negative on file at the Garden.

Material in various California herbaria has been studied and when specimens deposited in these collections are cited, the fol-

lowing abbreviations are used in parentheses: California Academy of Sciences (Calif. Acad.), Dudley Herbarium at Stanford University (Dudl. Herb.), Pomona College (Pom.), Rancho Santa Ana Botanic Garden (R. S. A.), and University of California at Berkeley (U. C. and U. C. Veg. Type Map Herb.).

The collections made by the Garden staff, particularly by Wolf, Wolf and Everett, Wolf and Johnson, and Everett were for the most part in large series and are being widely distributed to herbaria of this country and to a few abroad. There they may be consulted under the numbers listed in this paper as *Coll. No.* (see paragraph above).

For many years it has been a general practice at Rancho Santa Ana Botanic Garden to preserve seedlings of most of the different kinds of material being propagated. For the most part, these have been put up in 4-ounce glass bottles with bakelite caps, in a preservative consisting of 5 per cent formalin, 5 per cent glacial acetic acid and 90 per cent of 70 per cent ethyl alcohol. The seedlings have ordinarily been taken from the seed flats or beds in the nursery and usually represent several stages of growth from the first appearance of the stem above ground to a plant of about 5 cm. in height, but on which the cotyledons may still remain. Labels are typed or written with waterproof ink and placed within the bottles. Refilling has been necessary at intervals of three or four years at which time most bottles require only about 10 or 15 per cent new liquid. Unless broken, such bottles of seedlings should last indefinitely and are invaluable for comparative purposes, since it is seldom possible to grow all of the species of a group, genus, family or other unit at any one time.

In the case of *Cupressus*, the preserved seedlings ordinarily range from those in which the cotyledons have not yet completely emerged from the seed coat to those with a dozen or more pairs of needle-like leaves, but with the cotyledons still present and functional. Of the New World species of *Cupressus*, only *C. glabra*, *C. guadalupensis* and *C. montana* are not represented in these pickled collections, although the two latter species were propagated in the nursery.

GENERIC CONCEPTS AND LIMITS OF CUPRESSUS

The genus *Cupressus*, as here delimited, comprises about twenty or more species, all found in the northern hemisphere, confined to temperate regions and distributed in the Old World from the Mediterranean regions to China, and in the New World from the western United States to Mexico, Guatemala, and Costa Rica. Linnaeus (*Genera*, 1737) accepted Tournefort's genus *Cupressus*, derived from an ancient Greek word applied to the Italian

Cypress (*Cupressus sempervirens*). However, the Linnaean generic concept was rather loose and all-inclusive, and it is probable that he never knew but one true cypress (*C. sempervirens*), for even in his *Species Plantarum* ed. 2. 2: 1422-23. 1763 he listed three others which are now regarded respectively as species of *Taxodium*, *Chamaecyparis* and *Callitris*. In his *Supplementum* (page 421) in 1781 he lists *Cupressus japonica* which is a species of *Cryptomeria*. Other authors have since included many plants in *Cupressus* which properly belong in other genera, such as *Thuja*, *Juniperus*, *Libocedrus* and even *Araucaria*. Some of these plants were referred to *Cupressus* because of an enlarged concept of the genus, while others appear to have been the result of errors or inadequate material.

Within the *Cupressaceae* the genera are, for the most part, rather readily distinguished from each other if mature ovulate cones are available, whereas the vegetative features of several genera are so similar that attempts at determinations are hazardous. *Cupressus* is distinct from other genera in its ovulate cone, usually composed of 4, 6, 8, 10 or even 12 peltate scales, most of which bear numerous irregular seeds and mature in two seasons. The juvenile leaves are needle-like, but the mature ones are scale-like, mainly closely-appressed to the branchlets and with a microscopically apparent fimbriate or ciliate margin. Species of *Callitris* and *Juniperus* have foliage practically indistinguishable from that of *Cupressus*, but the former has ovulate cones with valvate scales, and the latter has a berry-like, indehiscent ovulate cone with connate scales. I have seen first-season ovulate cones of *Juniperus californica* and *J. utahensis* which externally look remarkably like young cones of *Cupressus*. *Chamaecyparis* is, apparently, the genus most closely related to *Cupressus*. It differs, however, in generally having much smaller ovulate cones which mature in one season, in having only one to four or five seeds per scale, and in its entire-margined leaves which are generally produced on flattened, rather than quadrangular or terete branchlets. In her monograph of *Cupressus*, the details of which are discussed later, Camus regarded the genus as composed of two sections of which *Chamaecyparis* was one. Bentham and Hooker (*Gen. Pl.* 3: 427. 1880-3) regarded *Chamaecyparis* as a division of *Thuja* instead of a separate genus or a part of *Cupressus*.

The present paper confines itself to an account of the species of *Cupressus*, that is the *Eu-Cupressus* of Camus, which are native to the New World. The concentration of species in the western United States, particularly in California, has made it possible to study the major portion in the field as well as in the herbarium and in cultural plots. Had the European and Asiatic species been included they could not have been similarly studied,

and I am extremely doubtful if I could have added anything worth while to the knowledge about them if I had attempted to treat them at this time—particularly since none of them appears to be closely related to our New World species, and also since none except *Cupressus sempervirens* is of any great horticultural importance.

SPECIFIC CONCEPTS

In the course of my studies on *Cupressus*, I have frequently been asked as to whether I expected to recognize large species or small species; in other words, whether I was going to upset the established nomenclature either by drastic consolidations or by recognition of every variation as a named taxonomic unit.

I regard the present taxonomic treatment as somewhat intermediate between the above extremes. The species recognized are by no means equally well separated from each other; some are rather easily distinguished by clearly evident morphological characters, while others are difficult and lack such convenient features. In only one instance (*C. Bakeri*), have I concluded that units of less than specific rank were necessary. In that species two subspecies are recognized, in which minor morphological characters are correlated with geographic distribution. I have no doubt that some nomenclaturist will deem it essential to change these subspecies to varieties.

Numerous horticultural varieties have been named, practically all in Europe, and are given no formal recognition in my taxonomic treatment for several reasons: (1). Most of them are unknown in cultivation in the New World. (2). Many of them are very doubtfully referable to a given species without an adequate study of living material. (3). Such varieties are not distinguishable in the wild stands. (4). I believe that English or popular names would be much more preferable for the innumerable horticultural variations which could be segregated in *Cupressus* and perpetuated readily by vegetative propagation. For instance, if the columnar form of *C. glabra* should be deemed worthy of use in horticulture, then it might be appropriate to designate it as the "Columnar Smooth Arizona Cypress" or *C. glabra*—"Columnar."

Furthermore, I wish to emphasize that I do not regard the question as to ease or difficulty of identification (keying out of species) as the primary criterion in recognition of taxonomic entities. Some clearly evident character may be exceedingly useful in formulating an artificial key, but may well represent only an insignificant variation of no fundamental proportion.

The most drastic treatment of the New World species of

Cupressus which I can conceive would be the reduction of the group to seven species as follows:

- 1). *C. macrocarpa*.
- 2). *C. Goveniana*, with *C. Abramsiana*, *C. pygmaea* and *C. Sargentii* as minor units (i. e. subspecies).
- 3). *C. guadalupensis*, with *C. Forbesii* as a minor unit (i. e. subspecies) or reduced to synonymy.
- 4). *C. lusitanica*.
- 5). *C. Macnabiana*.
- 6). *C. Bakeri*.
- 7). *C. arizonica*, with *C. montana*, *C. nevadensis*, *C. glabra* and *C. Stephensonii* as minor units (i. e. subspecies).

However, I do not feel that such a taxonomic treatment would be at all satisfactory from a number of standpoints. It would still require the recognition of numerous subspecies, so that the number of taxonomic units would be about the same, except that a number of new combinations would be necessary. If all material were to be lumped into approximately seven species as outlined above and no subspecies recognized, then the treatment would be useless from a practical standpoint, for then the horticulturists would find it necessary to set up an elaborate set of names to distinguish the things which are so different; and I firmly believe that the major number of natural units of plants, whether they be in *Cupressus* or any other genus, should be established by botanists by orthodox taxonomic procedure.

CHRONOLOGICAL ACCOUNT OF NEW WORLD SPECIES OF CUPRESSUS

I recognize fifteen species of *Cupressus* as native of the New World. One of these is regarded as comprising two subspecies so that a total of sixteen taxonomic entities is here treated. The Mexican species here listed as *Cupressus lusitanica* may possibly represent more than one species and may need to be divided into two or possibly three species or subspecies when it is really adequately known and understood by extensive field studies.

The following chronological account of the description and discovery of most of the important New World entities in *Cupressus* is given below. For the most part, mere name changes are omitted here.

The first New World species of *Cupressus* to be described was *C. lusitanica* Mill. (1768). It is thought (Rehd., Cult. Evergreens, 210. 1927) to have been introduced into cultivation in Portugal about 1600, hence the specific name. It was long believed that this species had been brought from India and it was called Cedar of Goa. According to Miller, it was in cultiva-

tion in England long before Linnaeus published his *Species Plantarum* in 1753, so it is strange that neither there, nor in any subsequent writings did Linnaeus mention it. *C. Benthamii* Endl. (1847) and *C. thurifera* Schlecht. (1838) not H. B. K. (1817) are the most commonly used names for this species in the New World.

Cupressus macrocarpa Hartw. (1847) and *C. Goveniana* Gord. (1849) were the next to be described and were based on specimens collected at Monterey, California by Theo. Hartweg while there in 1846-47. It is apparent that the seeds of *C. macrocarpa* taken back to England by Hartweg were not the first to reach Europe, for Gordon (Journ. Hort. Soc. 4: 296 1849) in discussing the species credited to Hartweg, mentions that Lambert in 1838 had given the Horticultural Society some seeds of a cypress from which plants were raised, and to which he had applied the name *C. Lambertiana*. Some two or three years later, Gordon saw plants in cultivation at Mr. Low's nursery which were the same, and which he learned had been received from Dr. Fischer at St. Petersburg, as a new species of *Cupressus* from California. He also concluded that they were the same as Hartweg's *C. macrocarpa*. It would thus appear that *C. macrocarpa* first reached Europe via the Russians, and only because of failure to publish *C. Lambertiana* properly, that name is not applied instead of *C. macrocarpa*.

Cupressus Macnabiana Murr. (1855) was the next New World species to be described, it having been found in 1854 in California by William Murray.

Cupressus guadalupensis Wats. (1879) was the next species to be described, and was based on specimens collected by Dr. Edward Palmer on Guadalupe Island, off the west coast of Mexico, where it is endemic.

In 1882 E. L. Greene published *Cupressus arizonica*, based on specimens he had collected near Clifton in extreme eastern Arizona in September, 1880. This was followed by *C. arizonica* var. *bonita* Lemm. (1895) from the Chiricahua Mts., southeastern Arizona, and which I consider to be typical of the species. *Cupressus arizonica* is, possibly, the most widely distributed of any New World species and ranges from Arizona, New Mexico and Texas to parts of northern Mexico.

Cupressus Goveniana var. *pigma* Lemm. (1895) was next proposed and was based on specimens by Lemmon from the "White Plains, back from the coast, near Mendocino". However, in 1902 Lemmon, for some unexplained reason, described the same thing again under the var. *parva*. Sargent (1901) raised Lemmon's original var. *pigma* to specific rank under the name *C. pygmaea*, a disposi-

tion accepted here. The species is still unknown outside of Mendocino Co., California.

In 1909 Jepson added two more new species, both from California, under the names of *Cupressus Bakeri* and *C. Sargentii*. The former was a newly discovered plant from the lava beds of northern California. The latter had long been known and included under the all-inclusive *C. Goveniana*.

Cupressus glabra Sudworth (1910) was the next species to be described and was based on specimens he had collected in the Verde River Canyon, central Arizona. His species had been collected earlier by others and referred to *C. arizonica*, with which it has long been confused. In fact, most of the cultivated Arizona cypresses are *C. glabra*.

Cupressus nevadensis Abrams (1919) was the next species to be described, based on specimens he had collected in Kern Co., California in 1915. Two collections made earlier are known: one is by Leo Hertzinger, Aug. 30, 1907, and is in the Dudley Herbarium; the other is by Miss L. A. Hertzinger, March 18, 1911, and is in the Jepson Herbarium. Both of these collections were, apparently, sent respectively to Profs. Dudley and Jepson by the Hertzingers, who were local residents and were curious as to their identification.

In 1923 Jepson described *Cupressus Sargentii* var. *Duttonii* based on a specimen of his own collecting on Cedar Mt., Alameda Co., California. This variety is here regarded as a synonym of *C. Sargentii*.

Cypresses in the mountains of Orange and San Diego Cos., California and adjacent Baja California were long regarded either as *C. Goveniana* or *C. guadalupensis*. However, Prof. Abrams told me that when he was making his study of the trees and shrubs of southern California nearly forty years ago he submitted this cypress as a new species to Dr. Sargent for approval, but the latter persuaded him to refer the plants to *C. guadalupensis*. Dr. Munz also informed me that he and I. M. Johnston had concluded that the plants were a distinct species and were ready to publish it when Prof. Jepson (1922) published *Cupressus Forbesii* upon specimens collected in 1907 by C. N. Forbes in Cedar Canyon, San Diego Co., California.

The next New World species to be described was *Cupressus montana* by Wiggins in 1933, based upon collections he had made in the Sierra San Pedro Martir, Baja California. The trees from that area had long been confused with *C. guadalupensis* and *C. arizonica*.

No additional species have since been described in *Cupressus* for North America, although the discovery of a grove of *C. Sar-*

gentii in the mountains of Santa Barbara Co., California in 1935 led to considerable newspaper publicity which intimated that two, or perhaps three, new species or varieties had been found and would shortly be published. One of the varietal names has appeared in print, but is strictly a *nomen nudum* and was ill advised.

Cupressus Abramsiana from the Santa Cruz Mts., California, *Cupressus Stephensonii* from the Cuyamaca Mts., San Diego Co., California, and *Cupressus Bakeri* subsp. *Matthewsii* from the mountains of northern California and southern Oregon are here submitted for consideration as new entities in the genus. Of the three, only *C. Stephensonii* is really new, the others having been collected for many years.

It is possible, but I think highly improbable, that additional species of *Cupressus* will be discovered in the United States, although some segregations or consolidations of already known materials may occur. In Mexico, however, I suspect that additional species may be discovered, and that when the present *C. lusitanica* is really known it will require reconsideration and may yield more segregates.

TAXONOMIC TREATMENTS

Although the genus *Cupressus* has received considerable attention in various published works, the treatments have been largely portions of works on trees in general or parts of books dealing more specifically with the conifers. Parts of the genus have also been treated rather extensively in numerous local floras; and some species have been written up at length in special articles. The writings of Gordon and Glendinning, Carrière, Parlatore, Elwes and Henry, Dallimore and Jackson, E. L. Greene, J. G. Lemmon, C. S. Sargent, Sudworth, Rehder, Britton, Jepson, Abrams, and Kearney and Peebles are examples of the above types. They have been amply drawn upon wherever they dealt with the genus *Cupressus* and are cited in their proper places in the literature references given in the main body of the text under each species. On the other hand, only two papers have ever appeared which attempted to deal with *Cupressus* in a monographic sense. These were: 1) A general View of the Genus *Cupressus* by Dr. Maxwell T. Masters (Journ. Linn. Soc. 31: 312-363. 1896); 2). Les Cypprès. Monographie-Systematique. Anatomie-Culture. Principaux Usages, by A. Camus (105 pp., Paris, 1914).

Dr. Masters' paper appeared before several of the New World species of *Cupressus* had been discovered or described and is, therefore, inadequate from a modern standpoint. It is also apparent from his treatment of the New World species that he based his conclusions on herbarium materials, the published works of others, and

the limited numbers of cultivated cypresses available in Europe, and I think mainly in England. He recognized *C. lusitanica* Mill., but did not agree with Carrière that the Mexican species such as *C. Bentharii*, *C. Undeana* and *C. Lindleyi* belonged to that species. Masters regarded *C. Bentharii* Endl. as a Mexican and Guatemalan species and recognized vars. *Lindleyi* and *Knightiana* from Mexico and *arizonica* from northern Mexico and Arizona. His *C. macrocarpa* Hartw. included not only the native material from Monterey County, California, but also several vars. namely *fastigiata*, *Lambertiana*, *Crippsii*, *farallonensis* and *guadalupensis*. His *C. Goveniana* included material here referred to *C. pygmaea*, *C. Abramsiana* and *C. Sargentii*, as well as several horticultural varieties. His concept of *C. Macnabiana* was in accordance with mine. He also recognized *C. thurifera* H. B. K. as a valid Mexican species.

Mlle. Camus' rather elaborate monograph recognized *Cupressus* as containing *Eucupressus* and *Chamaecyparis*. Of the true cypresses she recognized *C. macrocarpa* with vars. *fastigiata*, *Lambertiana* and *guadalupensis*; *C. Macnabiana*; *C. Bakeri*; *C. Goveniana* and var. *attenuata*; *C. pygmaea*; *C. lusitanica* and vars. *Bentharii* and *glauca*; and *C. arizonica*. Her greatest difficulty seems to have been that she was confused about New World geography and either misdetermined some of her material in citing distribution, or depended on published references which were incorrect.

In my opinion, the two botanists who have given the most careful thought to the *Cupressus* of California, which means the major portion of the New World species, are Profs. Jepson and Abrams. The former's ideas are, in part, in print in his *Flora of California* (1909), *Silva of California* (1910) and *Manual of the Flowering Plants of California* (1923). The latter's views are incorporated in his treatment of *Cupressus* in his *Illustrated Flora of the Pacific States* (1923).

GEOGRAPHIC DISTRIBUTION

I have given the problem of the present geographic distribution of *Cupressus* in the New World considerable thought but am unable to arrive at any very satisfactory explanations. The most satisfactory theory seems to be that this very old group of species once occupied large portions of the temperate regions from western North America to Central America. In later times, either through climatic changes, diseases (such as the Cypress Canker which has practically wiped out the Monterey Cypress in cultivation in California), or by inability to compete with more aggressive species, the cypresses have been reduced to their present minor role in the vegetation. Examination of the present stands indicate that, for the most part, the cypresses occupy approximately all of the local area in each instance that is suitable for their growth, but

that they are not sufficiently aggressive to colonize adjacent areas. Their seed production and methods of dispersal are such that there is practically no possibility of them reaching any nearby suitable areas, even if such a spot were only a mile or two away. The species which I have studied in California and Arizona are subjected to another influence which most certainly will prevent them from increasing or, in most cases, from even holding their own, and which I believe may eventually result in their total destruction in the wild. This influence is man, and by the term I mean the effects of man's civilization which includes the clearing of land, grazing, fires and all of the other efficient means at his disposal for altering the normal biological cycles. For instance, a series of properly timed fires sweeping through the stands of some of the cypresses could result in the destruction of all of the mature trees in the first few fires and a destruction of the ensuing seedlings before they would have had time to produce seeds. Intensive grazing, such as has been reported for Guadalupe Island, could so effectively prevent the reproduction by seedlings that it would be only a matter of a short time before all of the old trees would reach maturity and disappear. Real estate development in Monterey County could eliminate the stands of *Cupressus Goveniana* on Huckleberry Hill and back of Point Lobos in a few years.

The total areas now occupied by cypresses in North America are so limited that it would be perfectly feasible to set the major portion of them (at least those stands in the United States) apart as cypress reserves where grazing, excessive cutting or other destructive agencies could be eliminated and adequate measures for protection from fire provided. Under such a program it is likely that these decadent species could hold their own for future generations to study and enjoy. Objectors to such measures would probably suggest that cypresses are hardly worth saving, yet I wonder if we should not seriously consider whether we are justified in the destruction of plants, animals, and other natural resources so effectively and so completely that the generations to come will only know of them as things of the past.

TABLE I
DISTRIBUTION OF NEW WORLD SPECIES OF CUPRESSUS

Species	Total Number of Groves or Stations	United States					Mexico					
		Oregon	California	Arizona	New Mexico	Texas	Baja California	Guadalupe Island	Northern Mexico	Central & Southern Mexico	Guatemala	Costa Rica
C. Abramsiana	3	T										
C. arizonica	13			T	X	X			X			
C. Bakeri Matthewsii	4	X	T									
C. Bakeri typica	2		T									
C. Forbesii	5		T				X					
C. glabra	7			T								
C. Goveniana	2		T									
C. guadalupensis	1							T				
C. lusitanica	?									T?	X	X
C. Macnabiana	15+		T									
C. macrocarpa	2		T									
C. montana	1						T					
C. nevadensis	2		T									
C. pygmaea	3		T									
C. Sargentii	19+		T									
C. Stephensonii	1		T									
Total Number	80+	1	11	2	1	1	2	1	1	1	1	1
Endemic species		0	9	1	0	0	1	1	0	0	0	0

X = One or more localities

T = Type locality

FIELD STUDIES

On September 1, 1927, I visited the "Pine Barrens" east of Fort Bragg, Mendocino County, California. There, for the first time, I saw cypresses growing in the wild and made my first herbarium specimens of the species *Cupressus pygmaea*. Each year since then, with the exception of 1932, I have visited at least one wild grove of cypresses. Many of these visits to cypress groves or stations have been planned primarily for the purpose, while others have been made in the course of other field work. However, at least since 1934, I have made it a point to spend as much time as I could legitimately take from other work in the study of the numerous stands of wild cypresses. Of the approximately 80 known localities for cypresses in the New World (exclusive of *C. lusitanica*) I have been fortunate enough to have visited about 60. As shown in the table following this discussion, my visits to wild groves have totaled 129 in the years from 1927 to 1944. As a result, I have seen living plants in the wild of all of the New World species of *Cupressus*, except *C. guadalupensis*, *C. lusitanica* and *C. montana*. These are, however, known to me in cultivation. *C. guadalupensis* has been cultivated in California almost since its discovery and mature trees are common so that lack of field work on Guadalupe Island has not been a serious handicap in arriving at an understanding of the species. *C. lusitanica* of Mexico, Costa Rica and Guatemala appears to be extremely variable, and extensive field work throughout its range would be highly desirable as is pointed out in my discussion of it in the text. *C. montana* of Baja California bears such a close relationship to *C. arizonica* and related species that I wish it had been possible to study it in the wild. As for the other species of the New World, I feel that I really know them intimately because of my long acquaintance with them in the wild, yet it would be highly hazardous to venture a determination as to species without adequate studies if a new grove or locality were reported.

Any attempt to summarize the amount of time and the distances traveled by me in field work on cypresses would be highly inaccurate and somewhat misleading, since so many of my visits to groves of cypresses have been combined with other field work. Also, a great deal of effort has been expended in searching for groves of cypresses which apparently never existed and which, in many instances, appear to have been reported on misidentification of material of *Juniperus*. A conservative estimate would be that I have traveled well over 10,000 miles by car, several hundred miles on foot or horseback and have spent at least 150 days which could be charged legitimately to fieldwork on the genus *Cupressus*.

In addition to my own field studies on cypresses, other mem-

bers of the Garden staff have also contributed materially to my knowledge of the genus, either from trips made by themselves or on the numerous occasions when they have accompanied me. John Thomas Howell was botanist at the Garden from 1927-1929, during which time he made collections of *C. Forbesii*, *C. macrocarpa*, *C. pygmaea* and *C. Sargentii*. In 1928 E. R. Johnson collected *C. Macnabiana* at Whiskytown, Shasta County. At various times from 1927-1934, B. D. Stark collected *C. Forbesii* and also accompanied Mr. Howell on a major trip in 1927. Since 1934 P. C. Everett has made several independent collections.

From 1926-1930 while I was a graduate student at Stanford University, I was fortunate in being able to make several general field trips. On one of these (1927), I made my first collection of cypress in the wild at Fort Bragg. In 1928 I learned to distinguish between *Cupressus Macnabiana* and *C. Sargentii* in Lake and Napa Counties, California. That same year I saw *C. macrocarpa* in the wild at Monterey for the first time, and during the summer, accompanied by H. A. Barker, now Professor of Microbiology at the University of California, I collected extensively in Arizona and New Mexico and saw fine specimens of *C. arizonica* in northern Sonora, Mexico, adjacent to the New Mexico line.

In 1930 I began work as botanist at Rancho Santa Ana Botanic Garden. That fall I was able to visit groves of *C. nevadensis* in Kern County; the stands of *C. Bakeri* subsp. *typica* in the lava beds of southeastern Siskiyou County; the curious forests of *C. pygmaea* in Mendocino County; a number of stands of *C. Macnabiana* and *C. Sargentii* in Napa and Lake Counties; the fine grove of *C. Sargentii* on Cedar Mountain, Alameda County; the picturesque *C. macrocarpa* at Point Cypress, Monterey County; the thickets of dwarf *C. Goveniana* on Huckleberry Hill adjacent to Point Cypress; and finally the grove of *C. Forbesii* on the slopes of Sierra Peak in the Santa Ana Mountains. This latter grove is scarcely more than a mile from the Botanic Garden, and the trees can be seen from the Garden almost any day of the year.

In 1931 I climbed the north side of Mt. Tecate, San Diego County with Dr. P. A. Munz and collected specimens of *C. Forbesii*. Later in the year, I again visited both groves of *C. macrocarpa* at Monterey; saw *C. Macnabiana* and *C. Sargentii* in Napa and Lake Counties, *C. pygmaea* in Mendocino County, and *C. Macnabiana* at Whiskytown, Shasta County, a locality thought to be the original spot where Murray discovered the species.

In the fall of 1933, accompanied by B. D. Stark, I saw *C. Macnabiana* in the Sierra Nevada between Grass Valley and Nevada City, Nevada County; and later again studied it and *C. Sargentii*

in Lake County.

In 1934 the really serious work on *Cupressus* was begun, and in October, accompanied by E. R. Johnson, I collected *C. Bakeri* subsp. *typica*, *C. Bakeri* subsp. *Matthewsii*, *C. pygmaea*, *C. Sargentii*, *C. Macnabiana* and *C. nevadensis*. Following this trip I collected by myself and obtained *C. macrocarpa*, *C. Goveniana*, *C. Abramsiana*, *C. Forbesii*, *C. Stephensonii* and *C. Sargentii*. As a result of this concentrated effort in the field in 1934, I found that I had visited 40 cypress localities representing all of the kinds now known to occur in the wild in California.

In 1938 I thoroughly explored the headwaters of King Creek in the Cuyamaca Mountains, San Diego County to determine the extent of distribution and the characteristics of *C. Stephensonii*.

In December, 1939, along with M. Van Rensselaer, Director of the Santa Barbara Botanic Garden, and several members of the United States Forest Service, I visited the grove of *C. Sargentii* located east of Zaca Peak in the San Rafael Mountains, Santa Barbara County.

In 1941 I visited the stands of *C. Bakeri* subsp. *typica* in the vicinity of Burney Mountain, Shasta County.

In the fall of 1942, accompanied by P. C. Everett, a special field trip to Arizona was made in an effort to visit every locality in that state where cypresses had been reported. As a result, four major stands of *C. arizonica* and six of *C. glabra* were located and studied. Numerous other supposed localities for cypresses were rather definitely demonstrated to have been errors, and the distinctions between *C. arizonica* and *C. glabra* were rather satisfactorily determined.

In the early spring of 1943, I was able to see the stand of *C. Abramsiana* on Eagle Rock, at the north end of Ben Lomond, a mountain in the Santa Cruz range. I visited also the stands of *C. nevadensis* on Piute Mountain, Kern County, and for the first time saw that species well laden with staminate cones in the midst of shedding their pollen.

In the fall of 1944, I was able to see stands of all the kinds of cypresses known to occur in California, except *C. Stephensonii*. In extreme northern Mendocino County, on one of that county's numerous "Red Mountains", I found a grove of *C. Sargentii*, which may not have been known previously. I also climbed Goose Nest Mountain in Siskiyou County to see for the first time its stands of *C. Bakeri* subsp. *Matthewsii*. Later in Kern County I visited the isolated grove of *C. nevadensis* in Back Canyon, which although known for a number of years had not come to my attention until 1943.

TABLE II
RECORD OF FIELD STUDIES OF CUPRESSUS 1927-1945*

Species	Number of Known Stations	Number of Stations Visited	Total Number of Visits	Tabulation of Visits to Individual Stations																		
				27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
<i>C. Abramsiana</i>	2+17	2	5								1			1			1			1	1	
<i>C. arizonica</i>	13+	5	5		1														4			
<i>C. Bakeri Matthewsii</i>	4	2	2								1										1	
<i>C. Bakeri typica</i>	2	2	4				1				1							1			1	
<i>C. Forbesii</i>	5	4	15				1	2		1	1	3	4					1			2	
<i>C. glabra</i>	7	6	6																6			
<i>C. Goveniana</i>	2	2	4			1	1				2											
<i>C. guadalupensis</i>	1																					
<i>C. lusitanica</i>	?																					
<i>C. Macnabiana</i>	15+12	27			1		1	2		2	11			3			4				3	
<i>C. macrocarpa</i>	2	2	11		1	2	1	2			2						1	1			1	
<i>C. montana</i>	1																					
<i>C. nevadensis</i>	2	2	4				1				1									1	1	
<i>C. pygmaea</i>	3	3	11	1			1	1			3					1		1			3	
<i>C. Sargentii</i>	19+17	33		2		1	2			1	16				3	1		4			3	
<i>C. Stephensonii</i>	1	1	2								1					1						
Totals	80+60	129		1	5	3	8	9		4	40	3	4	4	3	3	6	8	10	2	16	

* These represent solely visits to individual groves or localities by C. B. Wolf; visits by other members of Staff are discussed separately.

MOST OUTSTANDING GROVE OR STATION FOR EACH KIND OF CYPRESS
NATIVE TO THE NEW WORLD

CUPRESSUS ABRAMSIANA—Santa Cruz Cypress. Southwest slope of Ben Lomond, 7/10 miles east of the Bonnie Doon School, Santa Cruz Mountains, Santa Cruz County, California.

CUPRESSUS ARIZONICA—Arizona Cypress. About 18 miles north of Clifton, Greenlee County, southeastern Arizona, along the Coronado Trail (U. S. Highway No. 666).

CUPRESSUS BAKERI SUBSP. MATTHEWSII—Siskiyou Cypress. Seiad Creek, Siskiyou Mountains, Siskiyou County, California.

CUPRESSUS BAKERI SUBSP. TYPICA—Modoc Cypress. In the lava beds about 1 mile east of Timbered Crater, southeastern Siskiyou County, California.

CUPRESSUS FORBESII—Tecate Cypress. Either Otay Mountain or Mt. Tecate, both in southern San Diego County, California.

CUPRESSUS GLABRA—Smooth Arizona Cypress. In the vicinity of Oak Creek and Sedona, Coconino County, north central Arizona.

CUPRESSUS GOVENIANA—Gowen Cypress. Huckleberry Hill, between Carmel and Pacific Grove, Monterey County, California.

CUPRESSUS GUADALUPENSIS—Guadalupe Cypress. Mt. Augusta, Guadalupe Island, Mexico.*

CUPRESSUS LUSITANICA—Mexican Cypress. Vicinity of Mexico City, D. F., Mexico.*

CUPRESSUS MACNABIANA—McNab Cypress. On Red Hill, near Aukum, Amador County, California.

CUPRESSUS MACROCARPA—Monterey Cypress. Point Cypress, between Pacific Grove and Carmel, Monterey County, California.

CUPRESSUS MONTANA—San Pedro Martir Cypress. La Encantada, Sierra San Pedro Martir, Baja California, Mexico.*

CUPRESSUS NEVADENSIS—Piute Cypress. Red Hill, Piute Mountains, a few miles south of Bodfish, Kern County, California.

CUPRESSUS PYGMAEA—Mendocino Cypress. In the "Pine Barrens", a few miles east of the town of Fort Bragg, Mendocino County, California.

CUPRESSUS SARGENTII—Sargent Cypress. Cypress Mountain, between Cambria and Paso Robles, Santa Lucia Mountains, San Luis Obispo County, California.

CUPRESSUS STEPHENSONII—Cuyamaca Cypress. Headwaters of King Creek, Cuyamaca Mountains, San Diego County, California.

*Not based on personal observations of trees growing in the wild.

MORPHOLOGICAL FEATURES OF CUPRESSUS

The number of morphological features in *Cupressus* is comparatively small, and it is much easier to detect the similarities among species than it is to distinguish the differences. Attempts to determine species of *Cupressus* by means of the usual herbarium specimens have been rather unsatisfactory, as can be easily demonstrated by comparing some of the taxonomic treatments which have been based on such studies and without knowledge of the living plants. Few single characters in *Cupressus* are so constant or important that they can be relied upon to differentiate species. For this reason it is essential to give due consideration to the rather minute differences exhibited by all of the characters, and it is unsafe to depend upon a single morphological feature to enable recognition of a species. Prof. Jepson (Man. Fl. Pl. Calif. 57. 1923) in speaking of the genus has said: "The species depend for their separation on characters that are too vague and it might be better to receive a less number of them. Their history is as yet little known and new stations are still being discovered." I heartily agree with him that the species rest on rather insecure morphological features, but am not convinced that consolidations of any of the taxonomic units recognized in this paper would make for a better understanding of the group.

The most important morphological features of the New World species of *Cupressus* are discussed at some length below, and it is hoped that the reader of the main body of the text will consult this portion in order to gain a better understanding of the necessity of viewing each species in all of its features for a proper comprehension.

HABIT. Species of *Cupressus* in the New World vary from fruiting dwarfs 0.5 m. in height to rather stately trees of from 30 to 50 m. in height. Fruiting dwarfs of less than 1 m. in height are to be found in nearly every species, particularly when the plants grow in extremely sterile or rocky soil. These are ordinarily tree-like regardless of size; but sometimes, either through accident or lack of vigor, the central leader is equalled or surpassed by lateral branches. This is particularly common in *C. Macnabiana*, whose individuals are predominantly shrubby and only occasionally are really trees, and even then are seldom with a straight central leader. Many of the species ordinarily develop a straight central leader, and the crown is composed of numerous branches of minor significance in comparison to the size of the main trunk. This growth habit is common in *C. Sargentii*, *C. Bakeri*, *C. arizonica* and several other species. In other species the central leader is often not greatly longer than several of the more or less erect branches, so that a bushy round-topped or pyramidal tree results. This is characteristic of the growth of *C. Forbesii* and *C. guadalupensis*. Most species of *Cupressus* are very sensitive to lack of light and, as a result, when crowded lose

their lower branches. Dense stands are, thus, often composed of naked trunks with very limited crowns. On the other hand, individual trees with ample space for development frequently retain their branches practically to the ground throughout life and have rather massive crowns, which may be broadly pyramidal or even well rounded.

Most species of cypress have erect or spreading branches, but occasional trees have pendulous branches. Only one New World species, *C. lusitanica*, appears to have truly pendulous or weeping branches, and it is doubtful if this characteristic is constant for all of the forms regarded as belonging to that species.

WOOD. The wood of *Cupressus* is light colored with an inconspicuously differentiated sapwood of 20 to 30 rings and is not often very resinous. Under ideal growth conditions, annual growth is rapid, and the wood is rather coarse-grained. Where the trees are starved in sterile soil or crowded, they may have annual rings so close that it is difficult to count them, and a trunk 4 or 5 cm. in diam. may be 40 or 50 years of age. Counts of rings of wood from numerous species and observations as to maximum size lead to the conclusion that trunk diameters of more than 1.5 m. are rare, and that trees over 500 years of age would be exceptional.

The wood of the American cypresses has been used to a very limited extent for cabinet work, but many of the species are too little known and too rare to be important. In California the largest trees of *C. pygmaea* were early cut for their "cedar wood", and it is doubtful that many individuals of that species now remain which are large enough to be cut into lumber. Many of the stands of cypresses yield fence posts which seem to be durable when obtained from slow-growing trees, but even this usage is of minor importance. The wood of the native stands of American cypresses can, therefore, be said to be of practically no economic importance.

Britton (Trees No. Am. 97-101. 1908) gives the following notes on the wood of several cypresses: *Cupressus macrocarpa*—"The wood is hard and strong, but rather brittle, close-grained, light brown, or yellowish brown, with a satiny luster; its specific gravity is about 0.63. It takes a fine polish and is very durable." *Cupressus Goveniana*—"The wood is soft, brittle and weak, close-grained and light brown; its specific gravity is about 0.47." (Britton's species included *C. Sargentii* and *C. Forbesii*). *Cupressus pygmaea*—"The wood is soft, coarse-grained and brown." *Cupressus Macnabiana*—"The wood is soft, close-grained, and brown; its specific gravity is about 0.56." *Cupressus arizonica*—"The wood is soft, close-grained, grayish, with yellow streaks; its specific gravity is about 0.48. It is used locally for fuel and in construction."

BARK. The bark of the New World cypresses is of two sorts

with some overlapping of characteristics. In some species such as *C. macrocarpa*, *C. pygmaea* and *C. Sargentii*, the trunks of the old trees are covered with a rough, fibrous gray or dark brown bark which is usually split into longitudinal strips and attains a thickness of several cm. This is rather fire-resistant and protects the trees from the heat of fires which sometimes sweep through the stands. In other species such as *C. glabra*, *C. Forbesii*, *C. guadalupensis* and *C. Stephensonii*, the bark is non-fibrous and exfoliates annually in thin plates, leaving a rather smooth or polished red-brown, or mahogany-brown surface. In such instances, the bark of the larger branches is similar. A few species such as *C. nevadensis*, *C. montana* and *C. arizonica* have rough fibrous bark on the mature trunks, and somewhat smooth or polished bark on the branches, but in early life may have polished bark on the main trunk. These bark characteristics do not seem to be correlated sufficiently with other morphological features to warrant separating the genus into sections or subgenera on the basis of fibrous non-exfoliating bark vs. non-fibrous exfoliating bark.

BRANCHLETS. The branchlets of cypresses are produced on small branches and are either alternate or opposite, generally disposed more or less equally on all sides of the branches. However, occasional trees sometimes produce flattened branchlet systems in which the branchlets are all in one plane, hence, "thuja-like". *C. Macnabiana* has this type of branching rather well developed, but even in this species the flat sprays are seldom over 2 or 3 cm. in length. Some strains of *C. lusitanica* are also said to have flattened branchlet systems. Lateral branchlets seldom grow to much over 2 cm. in length before new lateral branchlets are formed. This frequent branching gives rise to a dense foliage system which, in most instances, makes it impossible to see through a tree. Like most other members of the *Cupressaceae*, the individual leaves are ordinarily not shed, but entire branchlets drop after about 2 or 3 years of growth.

FOLIAGE. The leaves of cypresses are of several sorts. Typical mature leaves are opposite, triangular, closely appressed to the branchlet and are seldom less than 1.5 mm. or over 2 mm. long. They are triangular with a blunt tip, a rounded or keeled back, a slightly ciliate margin, and may bear a depressed or raised circular or oval gland on the back. This gland or pit may be clearly visible on every leaf and actively exudes a clear resin which whitens as it dries. In other species the gland is, apparently, never active, may be visible as a closed pit, or is, apparently, absent on many leaves. Those species with active glands or pits on the leaves appear to be more closely related than those with inactive pits and in this treatment have been grouped together, although this feature has not been considered as of sufficient significance to warrant separation of the

species into a separate section or subgenus. The leaves may be green or gray. For the most part, the gray color is due to a bloom on the leaf surface and is variable at different times of the year. In the case of *C. Sargentii*, the bloom gives the tree a "dusty-green" appearance. In other species such as *C. guadalupensis*, the foliage is definitely a bluish green. Species such as *C. glabra* and *C. nevadensis* which have very active glands also have a rather heavy bloom on the leaves, and many individual trees are thus exceptionally gray or blue-gray in color. On vigorous branchlets the leaves are of short duration but become greatly elongated with a basal portion appressed to the branch and a free tip on which is borne the gland (when visible). Such leaves may become over 20 mm. long in some species. The juvenile leaves are distinctly different from the above two kinds of leaves, are linear, usually about 10 mm. long, spine-tipped and do not bear glands, even in the case of glandular species. These leaves are in whorls of 4 or opposite, and may be produced on seedlings for several years, but gradually give way by transitional leaf forms to the ordinary mature type of leaf.

STAMINATE CONES. The staminate cones are sometimes called flowers, but this term should be restricted to angiosperms. These cones (staminate strobili) are produced in great abundance, solitary at the tips of branchlets. When first visible they are hardly more conspicuous than adjacent tips of vegetative branchlets. They are usually first visible during the summer months but do not mature until late fall or spring, at which time they often give the trees a distinctly yellow color, and winds often lift clouds of pollen into the air. Each staminate cone is composed of a number of paired or opposite triangular scales (6 to 20, but ordinarily 8 to 12), each of these scales bears 3 to 10 pollen sacs arranged in an irregular row on its lower half. (Many botanists designate each of these scales as a stamen.) When mature, but prior to shedding pollen, the staminate cones may be cylindrical or slightly 4-sided, and tapered to the apex and base, and mainly 2 to 5 mm. in length; in others the cone is angular with 6 or 8 flat surfaces. At the time the pollen is shed, the cone-scales spread apart, and the sacs are clearly visible. Shortly after the pollen is shed, the entire cone drops from the branchlet. Differences in staminate cones are of taxonomic significance in differentiating some species (i.e. in *C. Forbesii* and *C. guadalupensis*, the staminate cones of the latter are composed of 14 to 18 scales, whereas, those of the former have 10 to 14 scales). The number of pollen sacs is also of some significance (i.e. in *C. macrocarpa* there are 6 to 10 pollen sacs per scale, whereas, in the other species of the group, the number is 6 or less). Pollen of *Cupressus* is rounded, not winged as in the genus *Pinus*. Examination of the pollen of several cypresses has disclosed no differences which could be used for differentiation of species.

OVULATE CONES. The ovulate cones require two seasons to mature and may then open and shed their seeds (i.e. *C. montana* and *C. lusitanica*), or they may remain unopened on the trees for many years, during which time the tissue remains alive, often has green cells beneath the surface, and the seeds do not lose their viability. When first visible, the ovulate cones are little more than an enlarged tip to a short branchlet. As they develop, the 6 to 10 or 12 scales enlarge and spread apart disclosing the very light green or nearly white ovules of which there may be more than 100 per cone. After pollination, which takes place from late fall to spring, the scales close and their margins which are slightly fimbriate become fused. During the first season, these scales develop into a globose cone, each scale of which is 4-, 6-, or 8-sided and somewhat flattened; near the middle of each scale a horn or umbo is produced. This may be conical and 2 or 3 mm. high, or crescent-shaped and rather inconspicuous. In some cones the lower and extreme upper pairs of scales are rather poorly developed. At the end of the first season, the cones are seldom over 10 mm. in diam., are generally green, tan or glaucous, and the horns are often much more pronounced than at maturity. During the second year, the cones grow to mature size, which varies from 10 mm. to 45 or even 50 mm. in diam. The surface becomes darker brown or grayish and is seldom as highly glossy as during the first year. Beneath the surface there are often pitch or resin pockets which give the cone a warty appearance. The seeds vary in number from around 60 to 150 per cone, and although some authors have attempted to state the number produced per scale, I have found it exceedingly difficult to determine the exact number of seeds on any one scale, although this might be possible by counting the scars where each seed was attached. The inner surfaces of the scales are usually polished-brown or glaucous. The seeds are extremely irregular in size, varying from 2 to 8 mm. in length, generally are slightly narrower, and are rather flattened or lens-shaped, with a narrow wing or margin. The hilum is often over 1 mm. long and is sometimes conspicuous because it is a different hue than the body of the seed which may be almost any shade of tan or brown, dull black or shiny black, and may be slightly or highly glaucous. Oftentimes minute pustules are visible with a hand lens. Differences of color and size of seeds are of some importance in distinguishing species of *Cupressus* (i.e. *C. pygmaea* is the only species with shiny black seeds; *C. guadalupensis* has glaucous seeds, while its close relative *C. Forbesii* has non-glaucous seeds).

SEEDLINGS. In germination the seed coat is carried above ground by the cotyledons and is then pushed off as they expand. The 3 to 5 cotyledons are at first erect, but soon turn at right angles to the main axis. Cotyledons are mainly about 10 mm. long, narrowly

linear, just slightly flattened and blunt at the tip; they remain green and functional for some weeks, and often do not drop off for months. The next leaves are very similar, but are not so fleshy and have a minute spine or mucro at the tip. As far as I can determine, there are no significant differences in the seedlings of different species except in the number of cotyledons which is fairly constant.

FIGURE 2.

Foliage of *Cupressus*. Photos July 12, 1945.

- A. *C. Forbesii*, fresh material of *Prop. No. 2335* showing slender branchlets which are also characteristic of *C. Goveniana*, *C. guadalupensis* and *C. pygmaea*. Neg. No. 6201.
- B. *C. Sargentii*, fresh material of *Prop. No. 252* showing the harsh, thick branchlets which, except for their inactive leaf glands, are characteristic of several species. Neg. No. 6207.
- C. *C. Macnabiana*, fresh material of *Prop. No. 2121* showing the flat (thuja-like) branchlet system of this species; also the active dorsal glands. Neg. No. 6213.

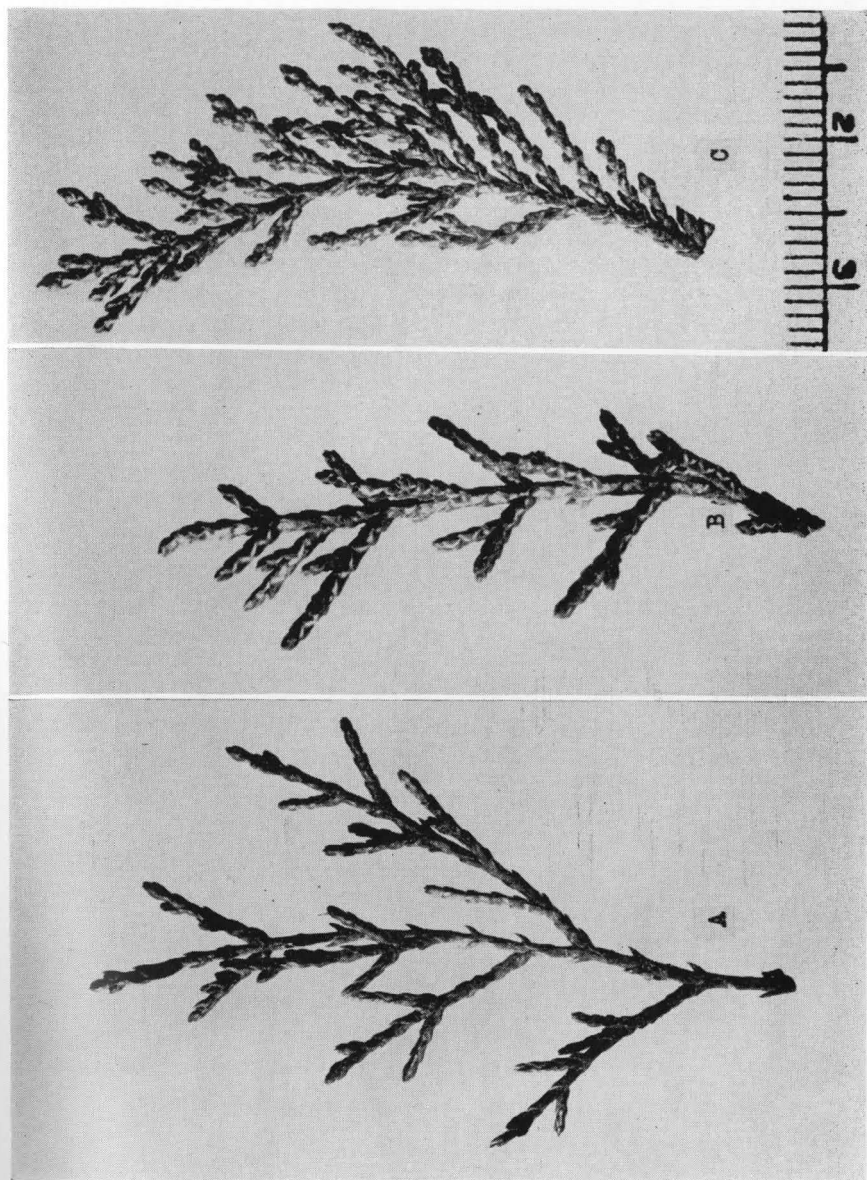


FIGURE 2. Foliage of Cypress.

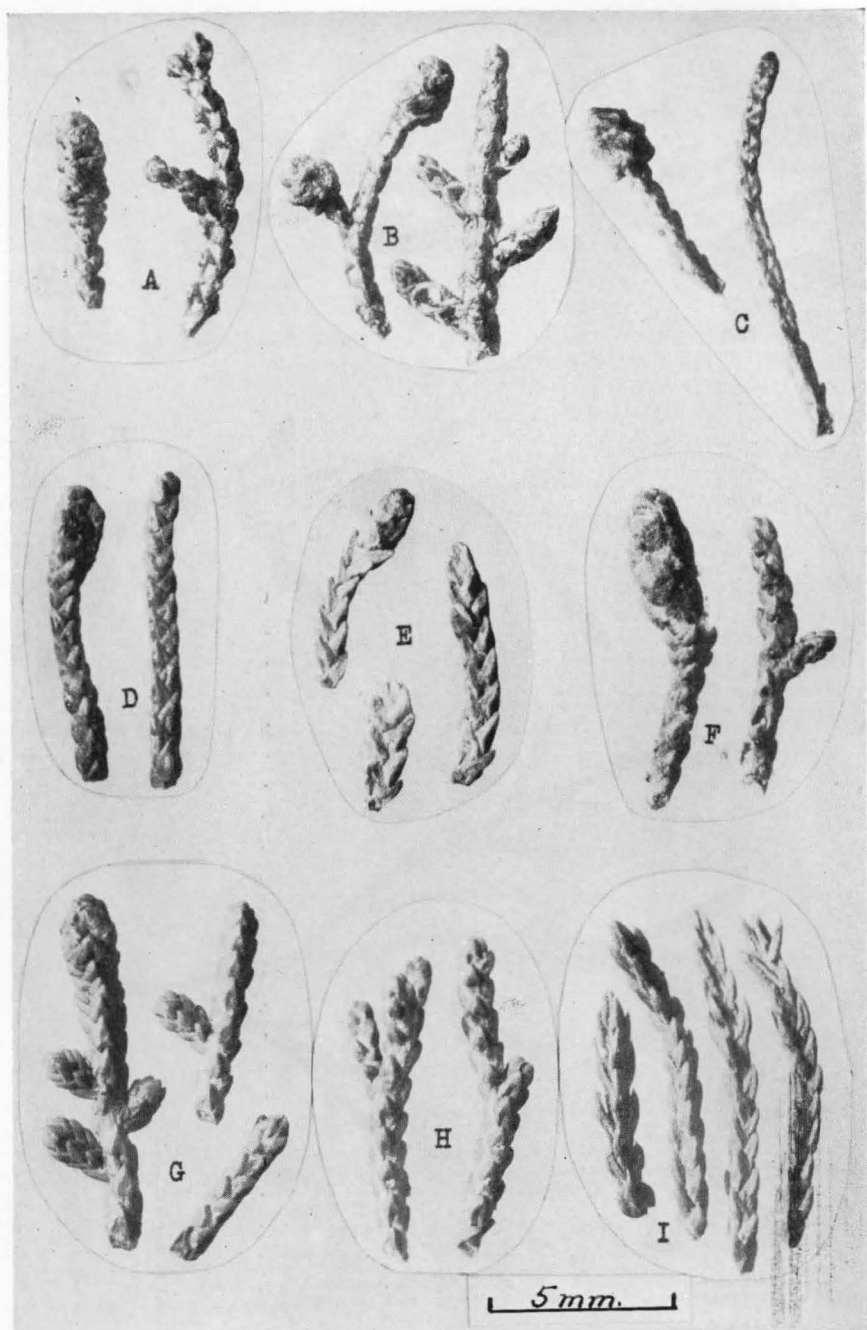


FIGURE 3.

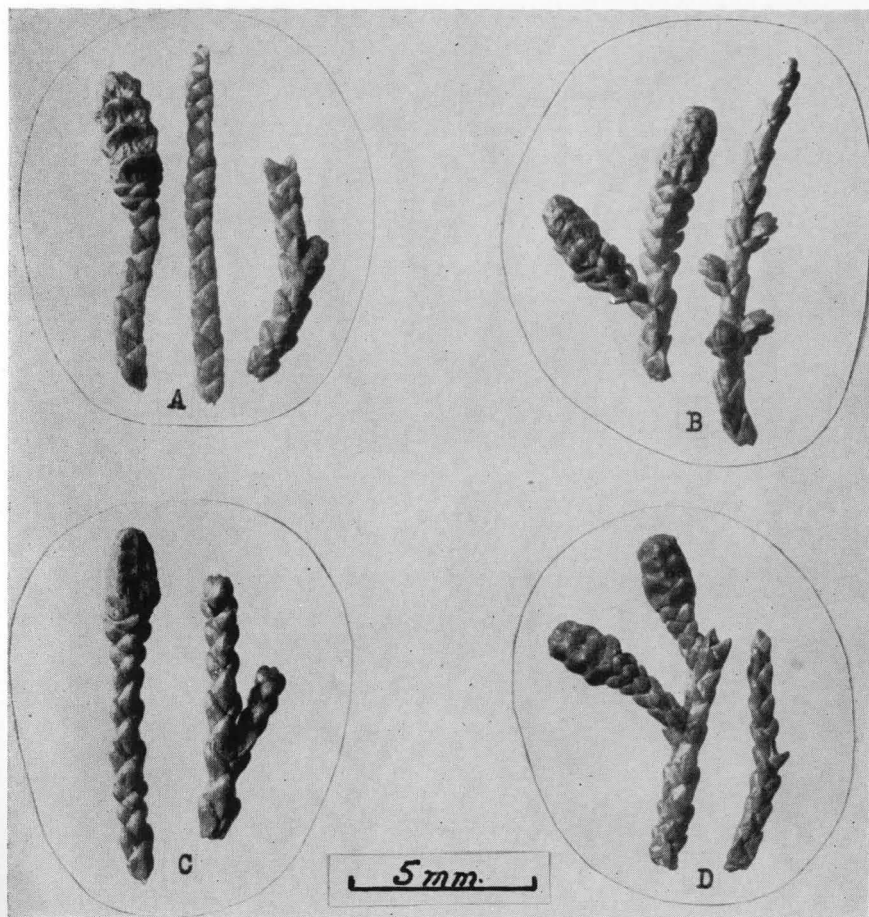


FIGURE 4.

Foliage and staminate cones of *Cupressus*. Photos July 10, 1945.

- A. *C. pygmaea*, Coll. No. 6174, Neg. No. 6161, ♂ and 2 veg.
 B. *C. Goveniana*, Coll. No. 6232, Neg. No. 6139, 2 ♂ cones and veg.
 C. *C. Abramsiana*, Coll. No. 6235 (type), Neg. No. 6127, ♂ and veg.
 D. *C. Sargentii*, Coll. No. 6195, Neg. No. 6184, 2 ♂ cones and veg.

FIGURE 3.

Foliage, staminate and young ovulate cones of *Cupressus*. Photos July 10, 1945.

- A. *C. Macnabiana*, Coll. No. 11474, Neg. No. 6147, ♂ and veg.
 B. *C. Bakeri typica*, Coll. No. 11481, Neg. No. 6131, ♂ and veg.
 C. *C. Bakeri Matthewsii*, Coll. No. 6169 (type), Neg. No. 6133, ♂ and veg.
 D. *C. montana*, Wiggins & Demaree 4990 (type), Neg. No. 6157, ♂ and veg.
 E. *C. arizonica*, Coll. No. 11388, Neg. No. 6128, ♂, ♀, and veg.
 F. *C. nevadensis*, Coll. No. 11444, Neg. No. 6159, ♂ and veg.
 G. *C. Stephensonii*, Coll. No. 6266, Neg. No. 6165, ♂ and veg.
 H. *C. Stephensonii*, Coll. No. 9467 (type), Neg. No. 6163, veg.
 I. *C. Stephensonii*, Coll. No. 11287, Neg. No. 6167, transitional veg. stages.

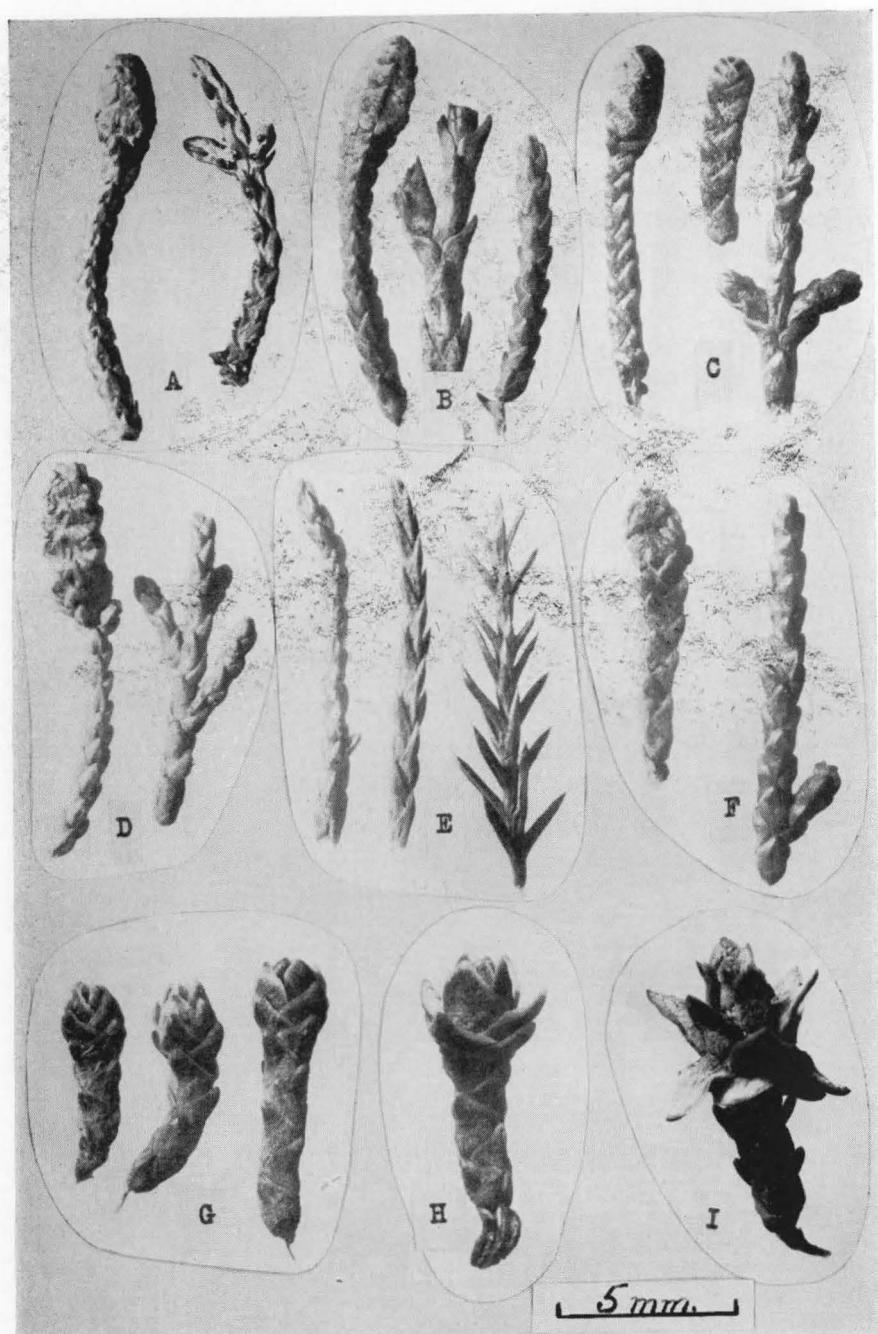


FIGURE 5. For explanation see page 31.

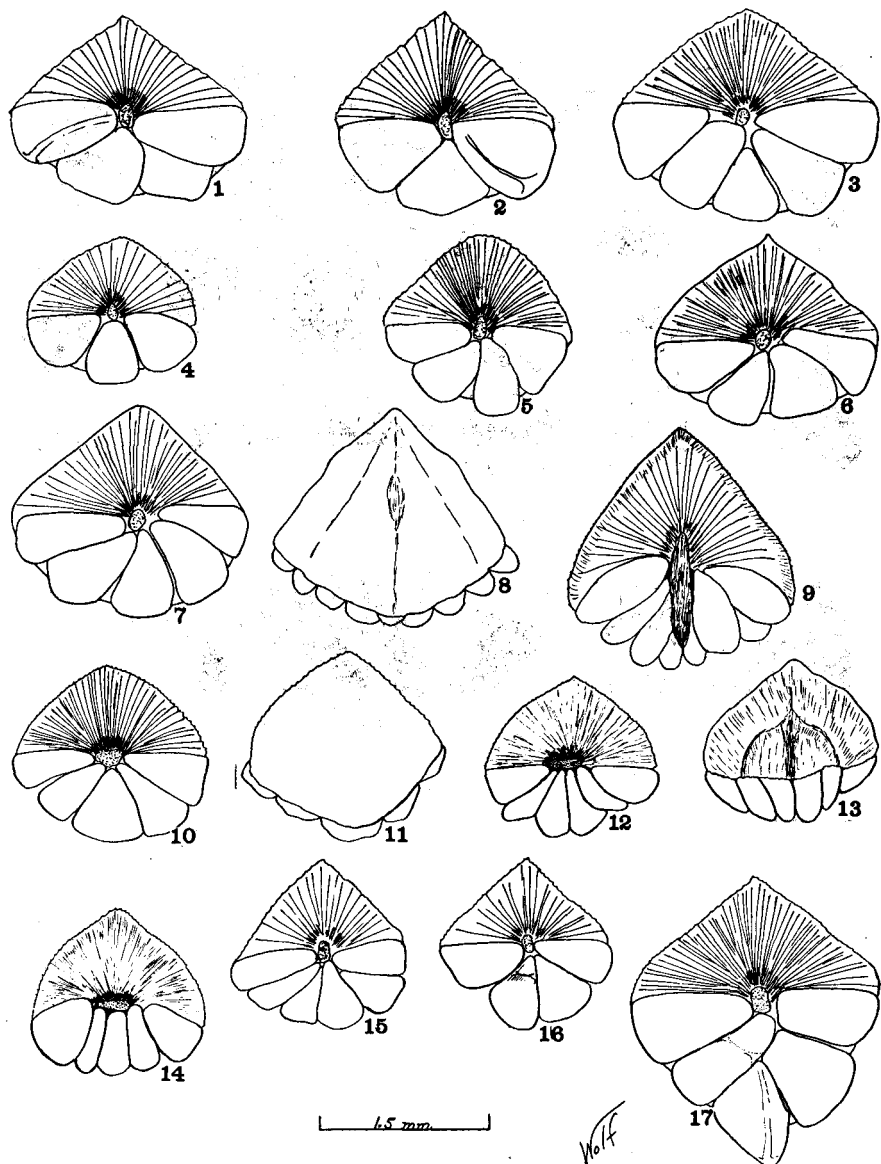


FIGURE A. Staminate Scales. For explanation see page 31.

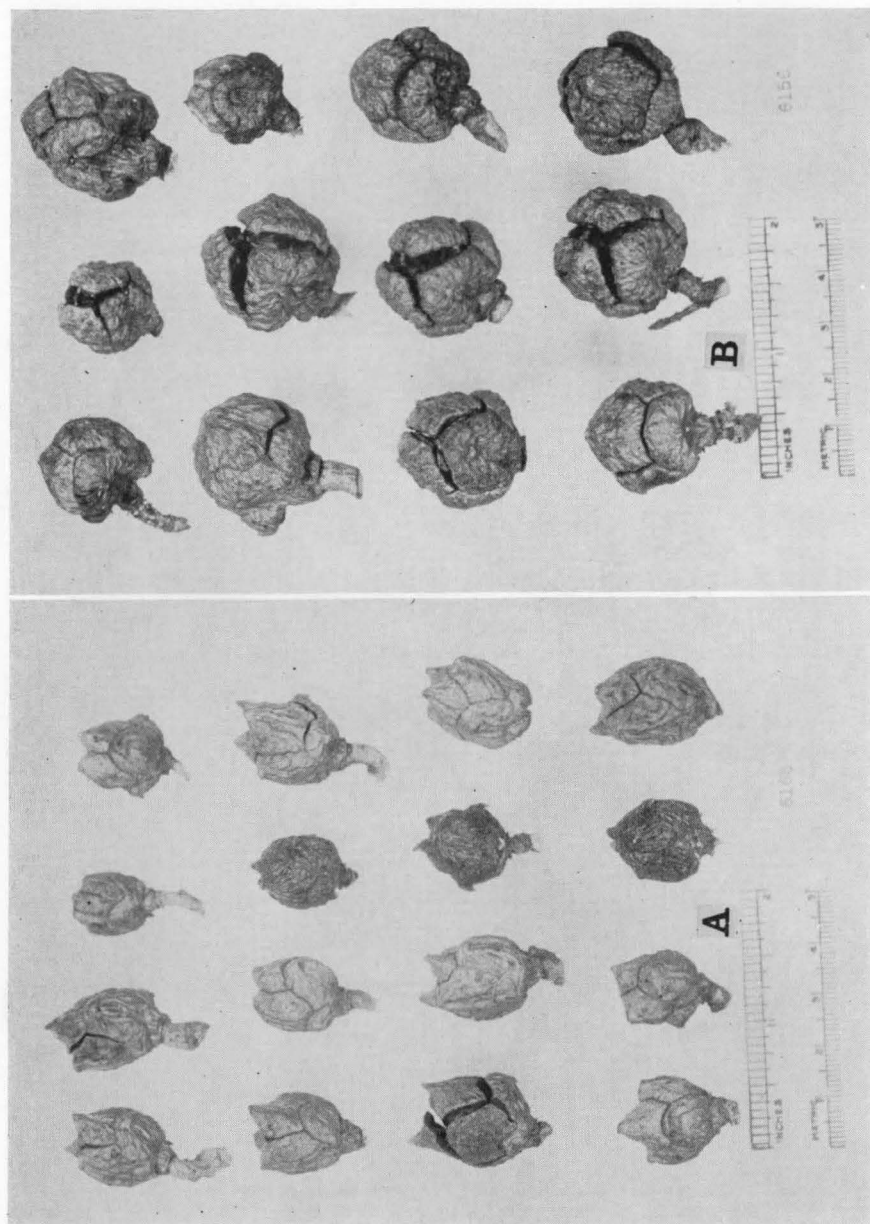


FIGURE 6. *Cupressus Macnabiana*. For explanation see page 31.

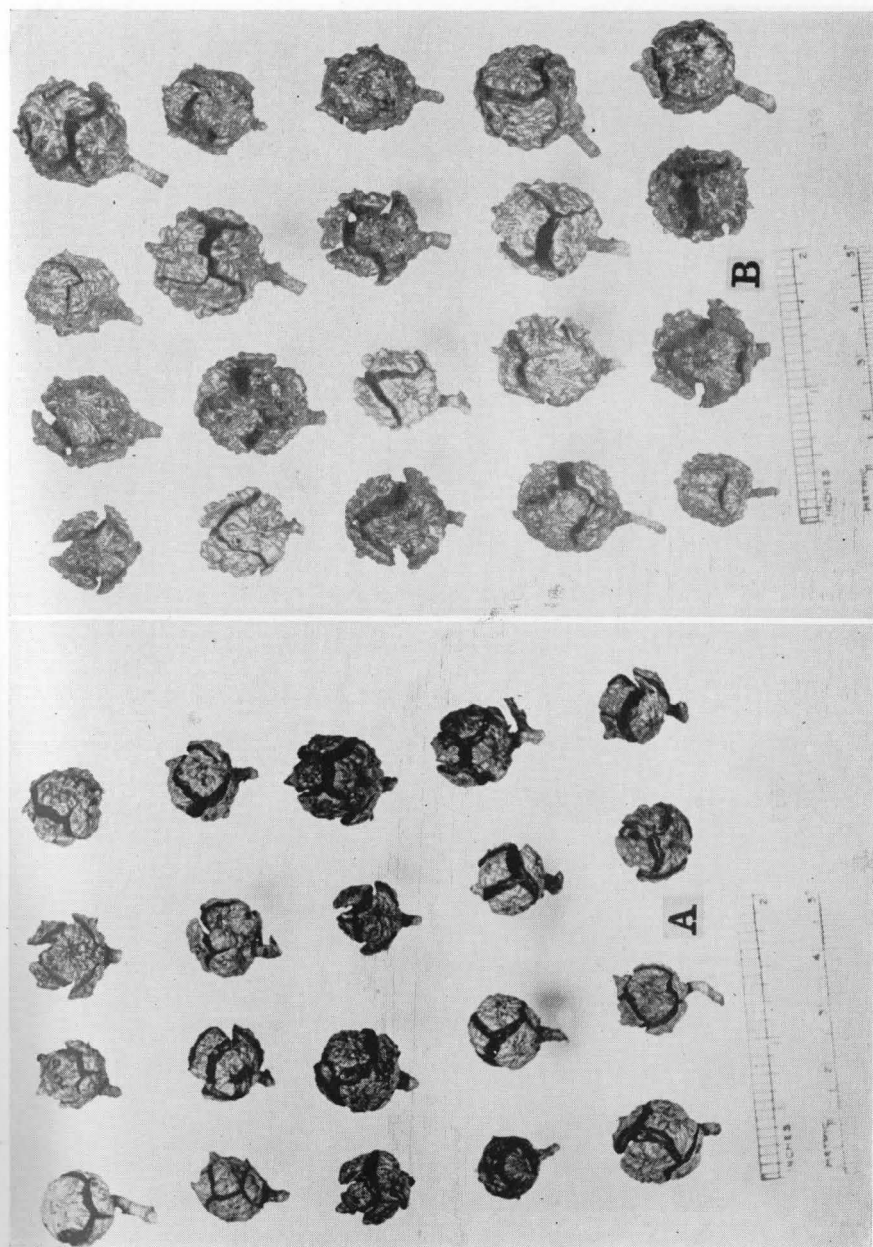


FIGURE 7. *Cupressus Bakeri*. For explanation see page 31.

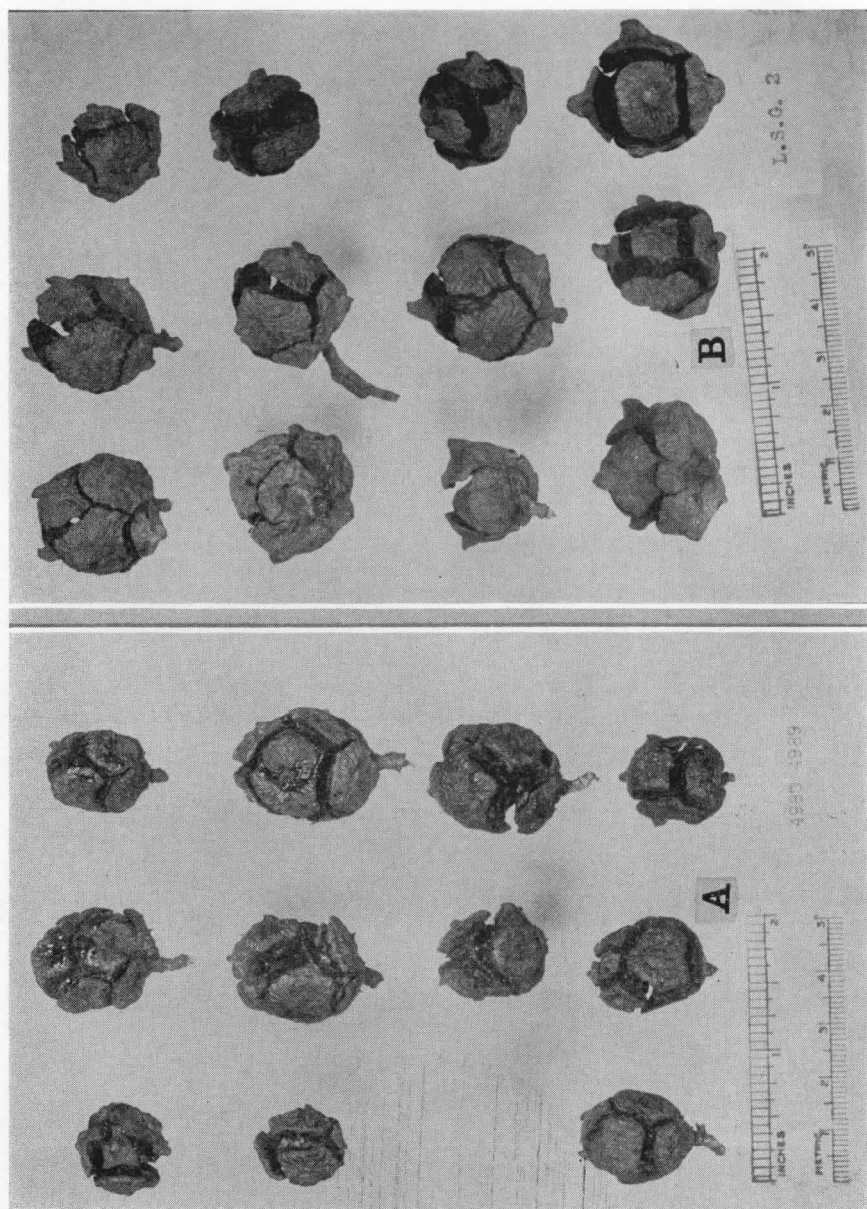
FIGURE 8. *C. montana* and *C. arizonica*. For explanation see page 31.

FIGURE 5.

- Foliage, staminate and young ovulate cones of *Cupressus*. Photos July 10, 1945.
- A. *C. glabra*, Coll. No. 11433, Neg. No. 6137, ♂ and veg.
 - B. *C. lusitanica*, fresh Prop. No. 2356, Neg. No. 6145, ♂ and 2 types veg.
 - C. *C. Forbesii*, fresh Prop. No. 221, Neg. No. 6135, ♂, ♀, and veg.
(Compare ♂ cone with that of *C. guadalupensis*.)
 - D. *C. guadalupensis*, Fleming, 1931, Neg. No. 6143, ♂ and veg. (Note large ♂ cone and compare with that of *C. Forbesii*.)
 - E. *C. guadalupensis*, Coll. No. 11288, Neg. No. 6141, mature, transitional and juvenile foliage from same plant.
 - F. *C. macrocarpa*, fresh Prop. No. 39, Neg. No. 6149, ♂ and veg.
 - G. *C. macrocarpa*, fresh Prop. No. 39, Neg. No. 6151, 3 very young ♀ cones.
 - H. *C. macrocarpa*, fresh Prop. No. 39, Neg. No. 6155, young ♀ cone at about time of pollination.
 - I. *C. macrocarpa*, fresh Prop. No. 39, Neg. No. 6153, young ♀ cone, after pollination, but scales not closed.

FIGURE A.

Scales from staminate cones of *Cupressus*. Unless otherwise indicated, the inner face is shown. The pollen sacs are attached in an irregular row or semicircle in the lower half of the scale adjacent to the central stalk by which the practically peltate scale is attached to the main axis of the cone.

1. *C. Macnabiana*—Prop. No. 1256. Fresh. A central scale.
2. *C. Macnabiana*—Prop. No. 1256. Fresh. A lower scale.
3. *C. Macnabiana*—Prop. No. 2148. Fresh. A lower scale.
4. *C. Bakeri typica*—Prop. No. 1006. Fresh. A lower scale.
5. *C. Bakeri typica*—Prop. No. 1006. Fresh. A central scale.
6. *C. Forbesii*—Prop. No. 221. Fresh. A lower scale.
7. *C. Forbesii*—Prop. No. 221. Fresh. A central scale.
8. *C. macrocarpa*—Prop. No. 39. Fresh. A central scale, outer face.
9. *C. macrocarpa*—Prop. No. 39. Fresh. A central scale.
10. *C. pygmaea*—Prop. No. 270. Fresh. A central scale.
11. *C. pygmaea*—Prop. No. 270. Fresh. A central scale, outer face.
12. *C. Goveniana*—Herb. No. 1813. Dried and restored. A central scale.
13. *C. Goveniana*—Herb. No. 1813. Dried and restored. A central scale, outer face.
14. *C. Goveniana*—Herb. No. 1813. Dried and restored. A central scale.
15. *C. Abramsiana*—Prop. No. 2185. Fresh. A central scale.
16. *C. Abramsiana*—Herb. No. 6235. Dried and restored. An upper scale.
17. *C. Abramsiana*—Herb. No. 6235. Dried and restored. A central scale.

FIGURE 6.

CUPRESSUS MACNABIANA—McNab Cypress.

- A—Ovulate cones. Coll. No. 6165 (Prop. No. 2126). Photo July 6, 1945. Neg. No. 5984.
B—Ovulate cones. Coll. No. 6156 (Prop. No. 2118). Photo July 6, 1945. Neg. No. 5981.

FIGURE 7.

A—CUPRESSUS BAKERI subsp. TYPICA—Modoc Cypress.

Ovulate cones; Coll. No. 6166 (Prop. No. 2127). Photo July 6, 1945. Neg. No. 5957.

B—CUPRESSUS BAKERI subsp. MATTHEWSII—Siskiyou Cypress.

Ovulate cones. Coll. No. 6169 (Prop. No. 2130), type coll. Photo July 6, 1945. Neg. No. 5960.

FIGURE 8.

A—CUPRESSUS MONTANA—San Pedro Martir Cypress.

Ovulate cones. Two cones at top of left hand row are Wiggins & Demaree No. 4980; other nine cones are Wiggins & Demaree No. 4989. Photo July 6, 1945. Neg. No. 5990.

B—CUPRESSUS ARIZONICA—Arizona Cypress.

Ovulate cones. Lake S. Gill No. 2 (Prop. No. 2357). Photo July 6, 1945. Neg. No. 5954.

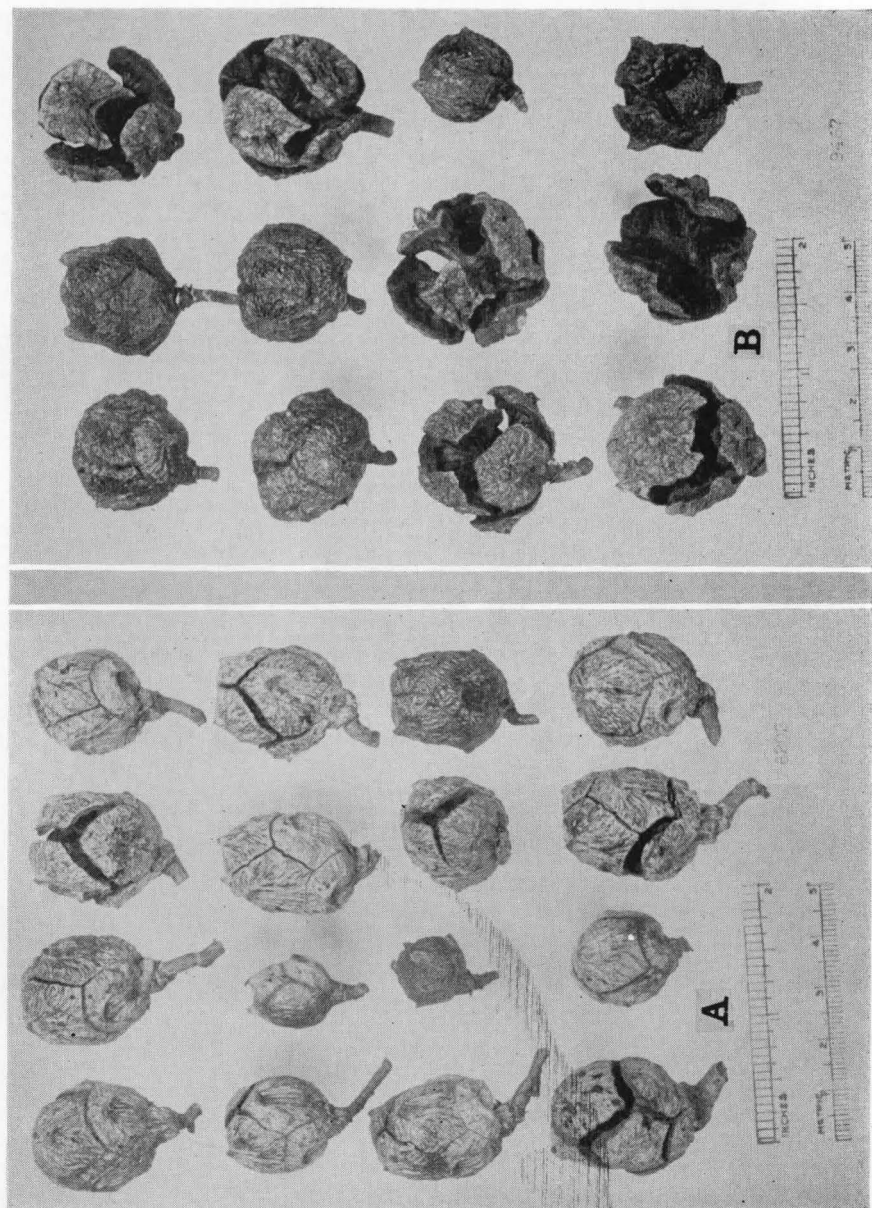


FIGURE 9. *C. nevadensis* and *C. stephensonii*. For explanation see page 37.

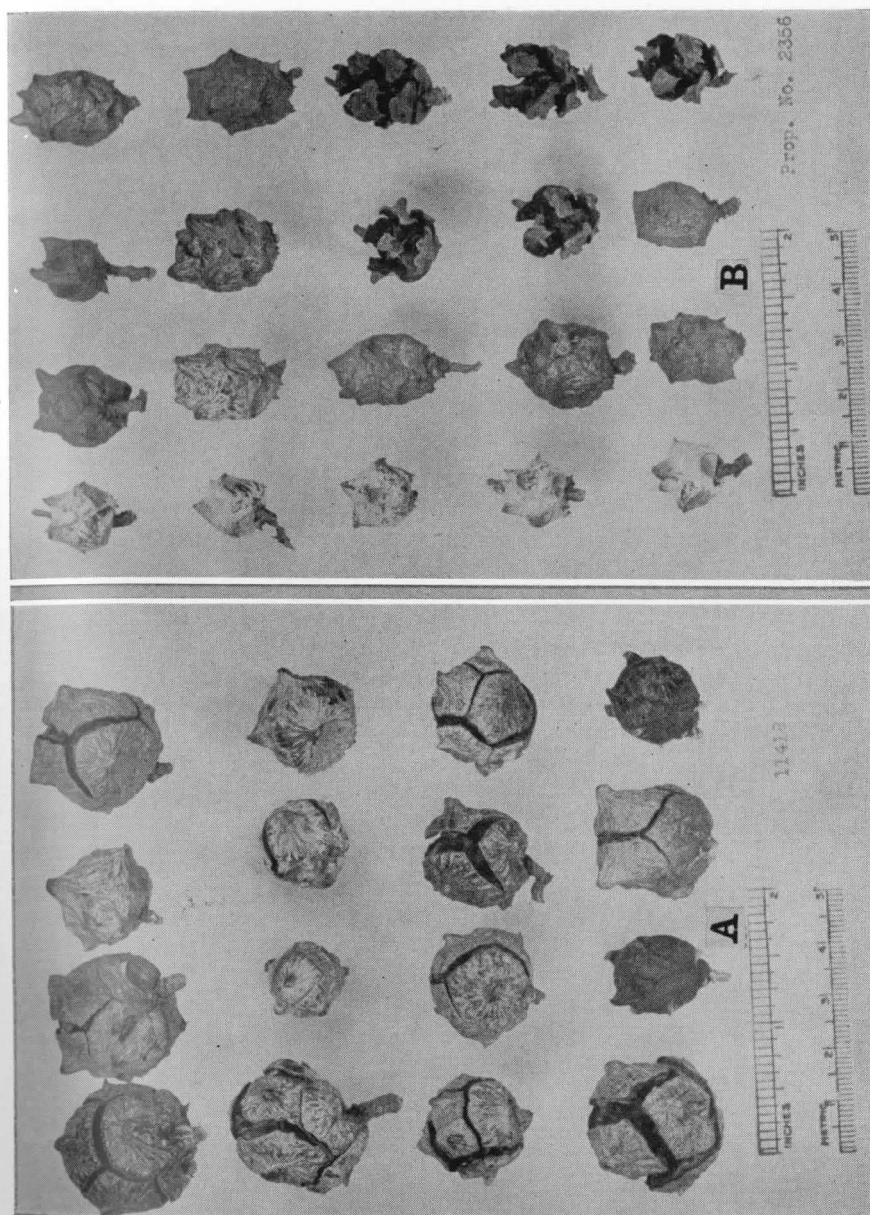
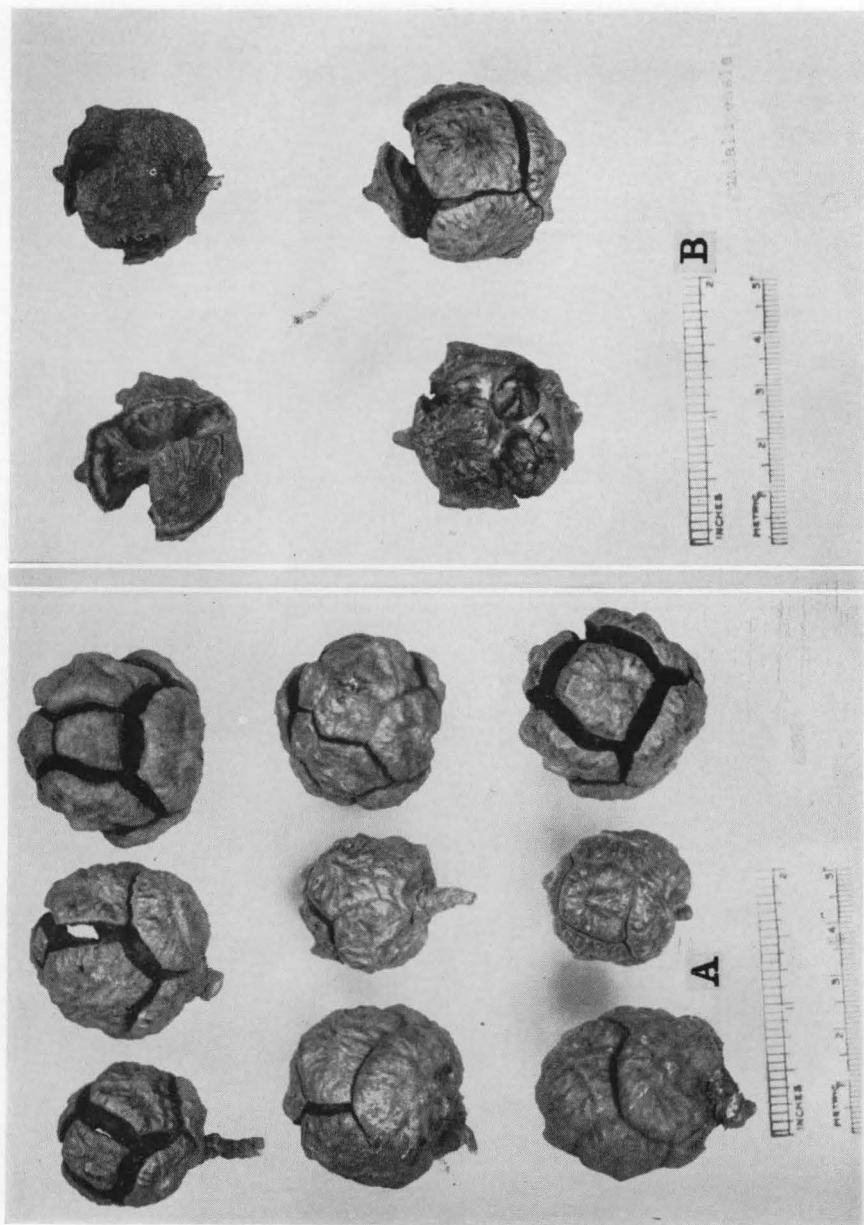


FIGURE 10. *C. glabra* and *C. lusitanica*. For explanation see page 37.

FIGURE 11. *C. Forbesii* and *C. guadalupensis*. For explanation see page 37.

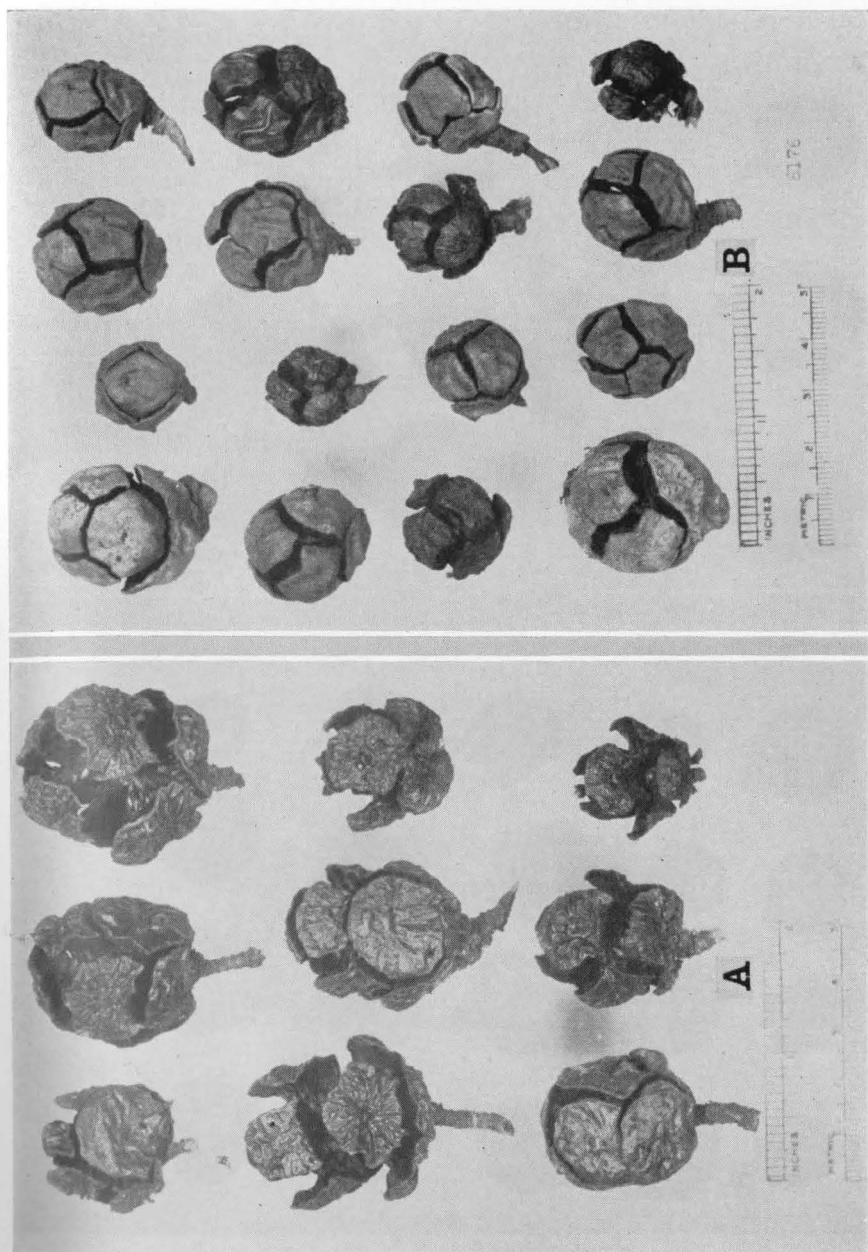


FIGURE 12. *C. macrocarpa* and *C. pygmaea*. For explanation see page 37.

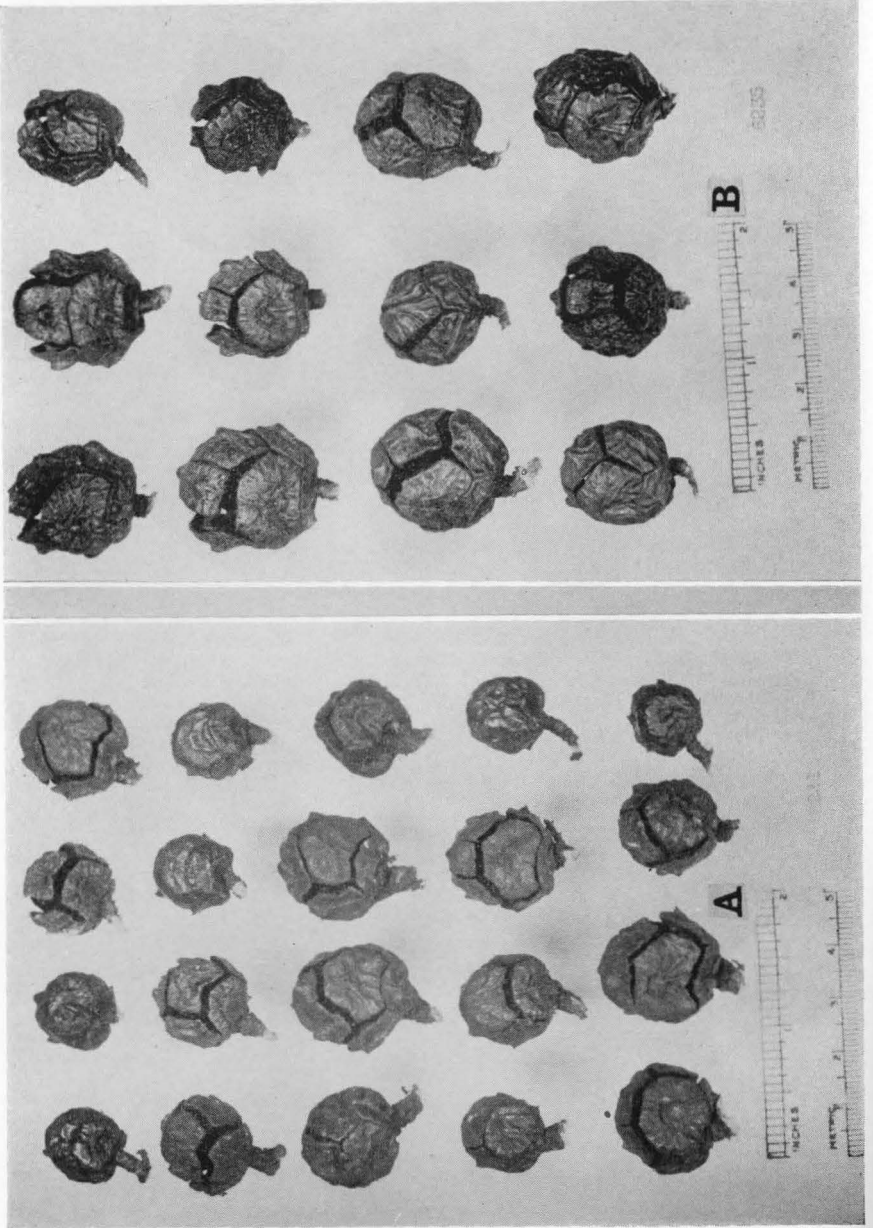


FIGURE 13. C. Goveniana and C. Abramsiana. For explanation see page 37.

FIGURE 9.

- A—*CUPRESSUS NEVADENSIS*—Piute Cypress.
Ovulate cones. *Coll. No. 6203* (*Prop. No. 2159*). Photo July 6, 1945. Neg. No. 5993.
- B—*CUPRESSUS STEPHENSONII*—Cuyamaca Cypress.
Ovulate cones. *Coll. No. 9467* (*Prop. No. 3370*), type coll. Photo July 6, 1945. Neg. No. 6006.

FIGURE 10.

- A—*CUPRESSUS GLABRA*—Smooth Arizona Cypress.
Ovulate cones. *Coll. No. 11418*. Photo July 6, 1945. Neg. No. 5966.
- B—*CUPRESSUS LUSITANICA*—Mexican Cypress.
Ovulate cones. *Prop. No. 2356*. Note the vegetative branch growing out of the tip of the first-year cones in left row top and third from top. Photo July 6, 1945. Neg. No. 5976.

FIGURE 11.

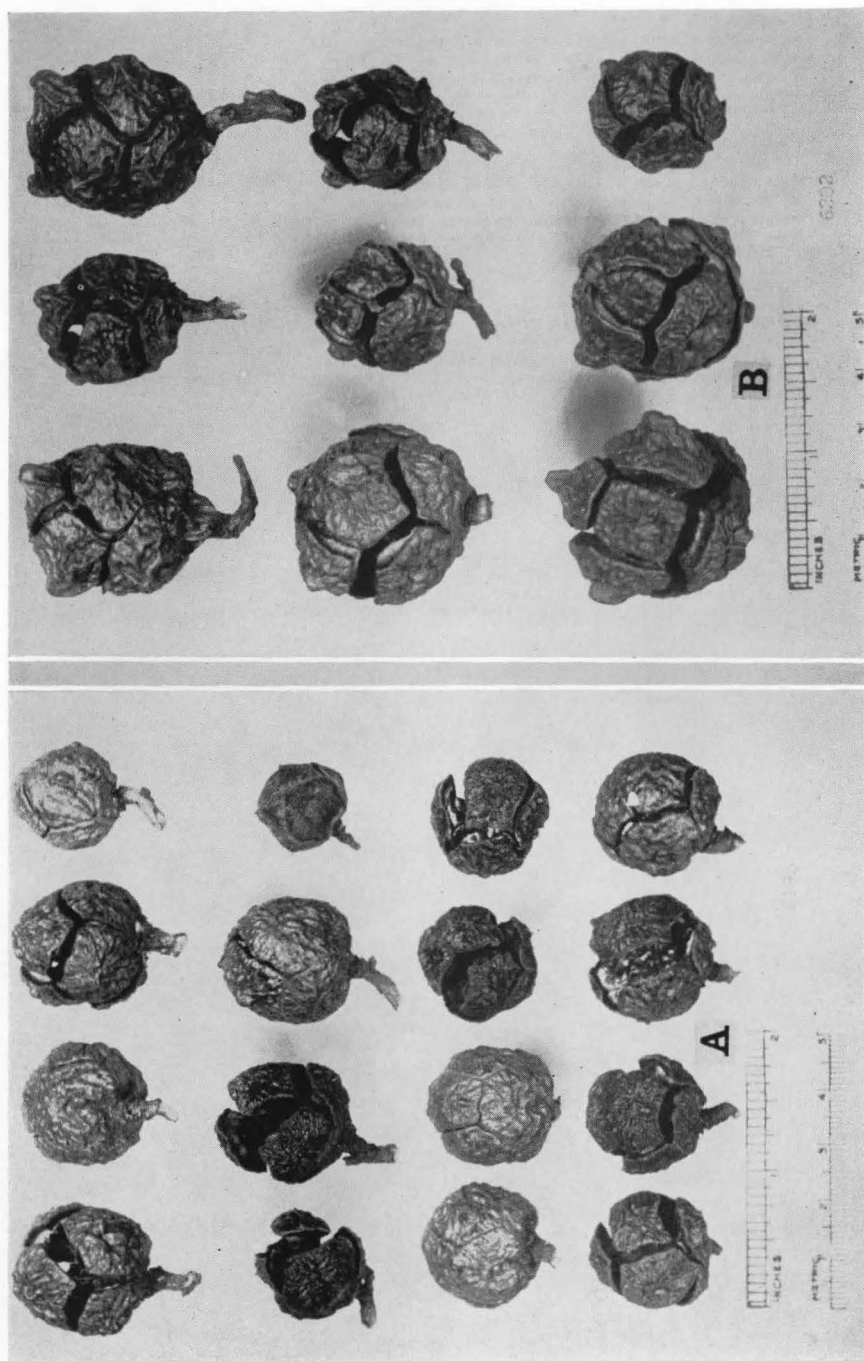
- A—*CUPRESSUS FORBESII*—Tecate Cypress.
Ovulate cones. *Coll. No. 6282* (*Prop. No. 2332*). These are larger than the average for the species but are not unusual. Photo July 6, 1945. Neg. No. 5963.
- B—*CUPRESSUS GUADALUPENSIS*—Guadalupe Cypress.
Ovulate cones. Lower right hand cone is *J. T. Howell No. 8297*; other three are *Guy Fleming, 1931*. Photo July 6, 1945. Neg. No. 5972.

FIGURE 12.

- A—*CUPRESSUS MACROCARPA*—Monterey Cypress.
Ovulate cones. *Coll. No. 6233* (*Prop. No. 2184*). Photo July 6, 1945. Neg. No. 5987.
- B—*CUPRESSUS PYGMAEA*—Mendocino Cypress.
Ovulate cones. *Coll. No. 6176* (*Prop. No. 2135*). Photo July 6, 1945. Neg. No. 5996.

FIGURE 13.

- A—*CUPRESSUS GOVENIANA*—Gowen Cypress.
Ovulate cones. *Coll. No. 6231* (*Prop. No. 2182*). Photo July 6, 1945. Neg. No. 5969.
- B—*CUPRESSUS ABRAMSIANA*—Santa Cruz Cypress.
Ovulate cones. *Coll. No. 6235* (*Prop. No. 2185*), type coll. Photo July 6, 1945. Neg. No. 5952.

FIGURE 14. *Cupressus Sargentii*.

HYBRIDS

Hybrids between species of conifers do not seem to be nearly as common as in the flowering plants. In the genus *Cupressus*, the evidence of hybridization seems to be exceedingly limited, although it may well be that under cultivation many hybrids have occurred which have been lost or undetected. Among the New World species of *Cupressus*, there is little opportunity for hybridization to occur naturally because of the isolation of the various species. A resumé of the evidence of possible hybrids in this group is given below.

The Monterey Cypress and the Gowen Cypress grow in close enough proximity at both the Point Cypress and Point Lobos areas for hybridization to occur by wind pollination, but I have seen no evidence of such hybrids, nor have I seen any printed accounts suggesting them. Carrière described *Cupressus cornuta* (Rev. Hort. 250. fig. 32. 1866) from a cultivated plant in France and considered it an intermediate form between *C. Goveniana* and *C. Lambertiana* (the *C. macrocarpa* of this paper). I have listed his species under *C. Goveniana*, and for additional discussion of it see the reference under that species.

Sargent Cypress and McNab Cypress grow together in many places in the California Coast Ranges, particularly in parts of Napa, Lake and Mendocino Counties, California. Miss Eastwood (Zoe 5: 11-13. 1900) once suggested that Carl Purdy regarded some of the cypresses on Red Mountain, Mendocino County as intermediates between *C. Macnabiana* and *C. Goveniana* (the *C. Sargentii* of this paper). By inference only, it is assumed that these were hybrids between the two species. Somewhat later Jepson (Silva, Calif. 49. 1910) said: "Carl Purdy tells me that on Red Mountain in southeastern Mendocino County there is an area of Sargent Cypress and an area of McNab Cypress. In the intermediate area occur numerous individuals, which in all their features indicate hybrid origin from the above parents." Prof. Jepson has kindly permitted me to examine all of the cypress material in his herbarium and there are, apparently, no collections by Mr. Purdy to substantiate his belief. Prof. Jepson has himself collected both *C. Macnabiana* and *C. Sargentii* (including the Type of the latter) on Red Mountain; but, apparently, did not note any hybrids. Prof. James McMurphy of Stanford University collected on this same Red Mt. near Ukiah in 1909. His material is now deposited in the Dudley Herbar-

FIGURE 14.

CUPRESSUS SARGENTII—Sargent Cypress.

A—Ovulate cones. Coll. No. 6195 (Prop. No. 2151). Photo July 6, 1945. Neg. No. 5999.

B—Ovulate cones. Coll. No. 6202 (Prop. No. 2158). Photo July 6, 1945. Neg. No. 6002.

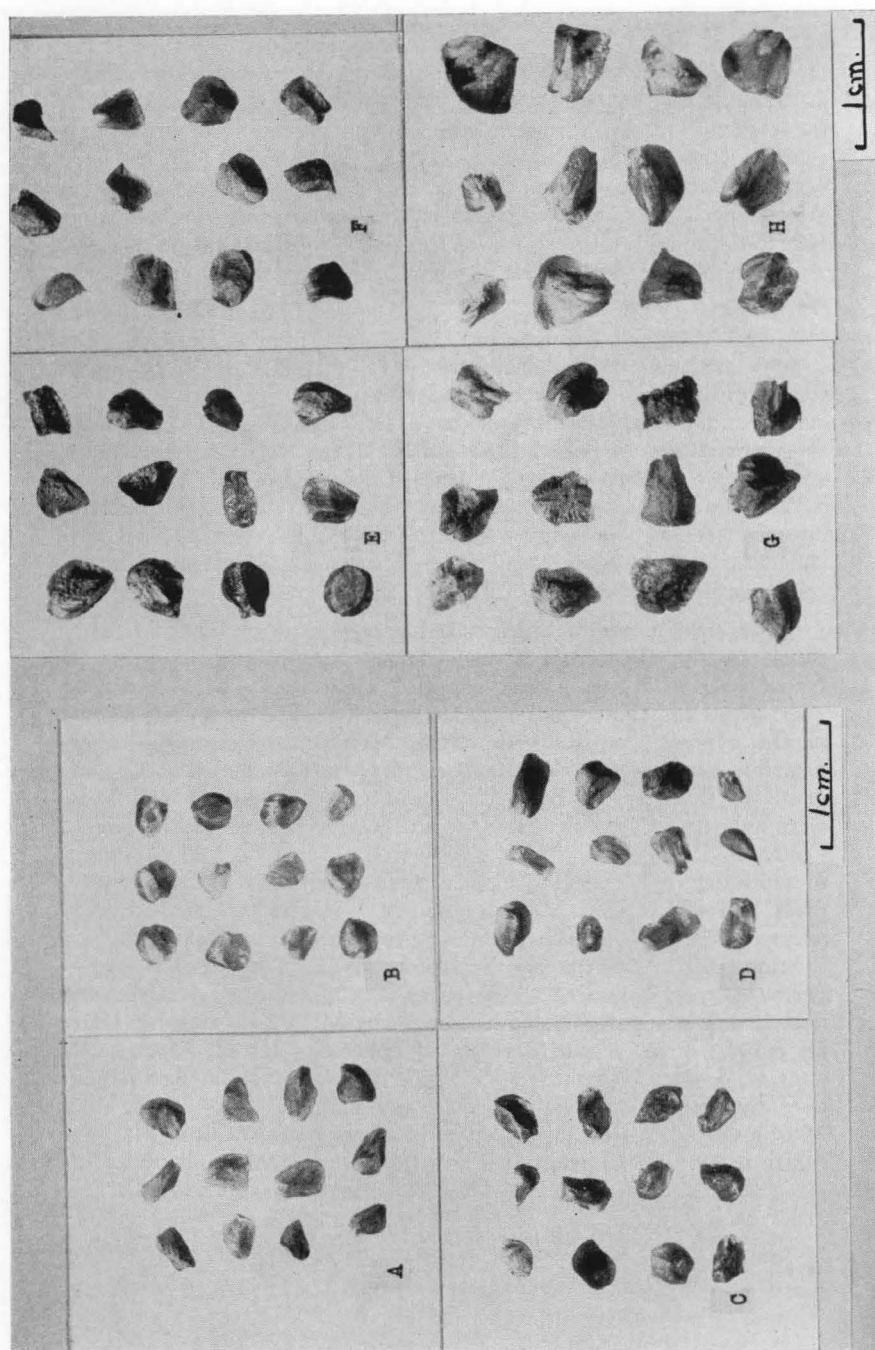


FIGURE 15. Seeds.

ium; both species are represented. His No. 672 has been labelled as a hybrid between *C. Sargentii* and *C. Macnabiana*, but I consider it to be good *C. Macnabiana*. On numerous occasions I have searched carefully for possible hybrids between *C. Macnabiana* and *C. Sargentii* where the two have been found growing together in the wild, but I have yet to see a plant which could not be readily referred to one or the other of the species.

There has been a rather common belief among California nurserymen and landscape architects that the Monterey Cypress (*C. macrocarpa*) and the Italian Cypress (*C. sempervirens*) have hybridized resulting in "off-type" Italian Cypresses. I have examined a great many such trees but have always been forced to conclude that they represented merely horticulturally undesirable strains of the Italian Cypress.

The most convincing evidence for hybridization in *Cupressus* seems to have been presented by A. B. Jackson and W. Dallimore in an article entitled: "A New Hybrid Conifer" (Kew. Bull. Misc. Inf. No. 3. 113-114. 1926), in which they describe *Cupressus Leylandii* as a hybrid between *C. macrocarpa* and *C. nootkatensis* (*Chamaecyparis nootkatensis* of many authors). Later M. L. Green proposed the generic name *Cupressocyparis* for Jackson and Dallimore's plant. Rehder (Man Cult. Trees and Shrubs ed. 2. 56. 1940) recognized *Cupressocyparis* as a bigeneric hybrid between *Cupressus* and *Chamaecyparis* and states that only *Cupressocyparis Leylandii* is known. I have not been able to see either living or pressed material of *C. Leylandii*, but the evidence presented by Jackson and Dallimore for its origin is convincing, and I concede that they are probably correct in their conclusion. Therefore, I think it worth while to quote their entire article describing this curious conifer which seems to have some horticultural merit, at least in England.

"The occurrence of a chance hybrid between the Yellow Cedar of the Pacific Coast of British Columbia and Oregon (*Cupressus nootkatensis* Don.) and the Monterey Cypress (*C. macrocarpa* Hartw.), which has a limited distribution in California, is of more than usual interest from the fact that the parent species are separated geographically and belong to different sections of the genus, or, as some authorities consider, to different genera.

"In July last a branch obtained from a cypress growing on the estate of Captain J. M. Naylor at Leighton Hall, near Welshpool,

FIGURE 15.

Seeds of *Cupressus*. Photos July 7, 1945.

A. *C. Macnabiana*, Coll. No. 11474. Neg. No. 6039.

B. *C. Bakeri* subsp. *typica*, Coll. No. 6166. Neg. No. 6025.

C. *C. Bakeri* subsp. *Matthewsii*, Coll. No. 6169 (type). Neg. No. 6027.

D. *C. montana*, Prop. No. 3367. Neg. No. 6043.

E. *C. arizonica*, L. S. Gill No. 2. Neg. No. 6023.

F. *C. nevadensis*, Coll. No. 6203. Neg. No. 6045.

G. *C. Stephensonii*, Coll. No. 9467 (type). Neg. No. 6052.

H. *C. glabra*, Coll. No. 11419. Neg. No. 6031.

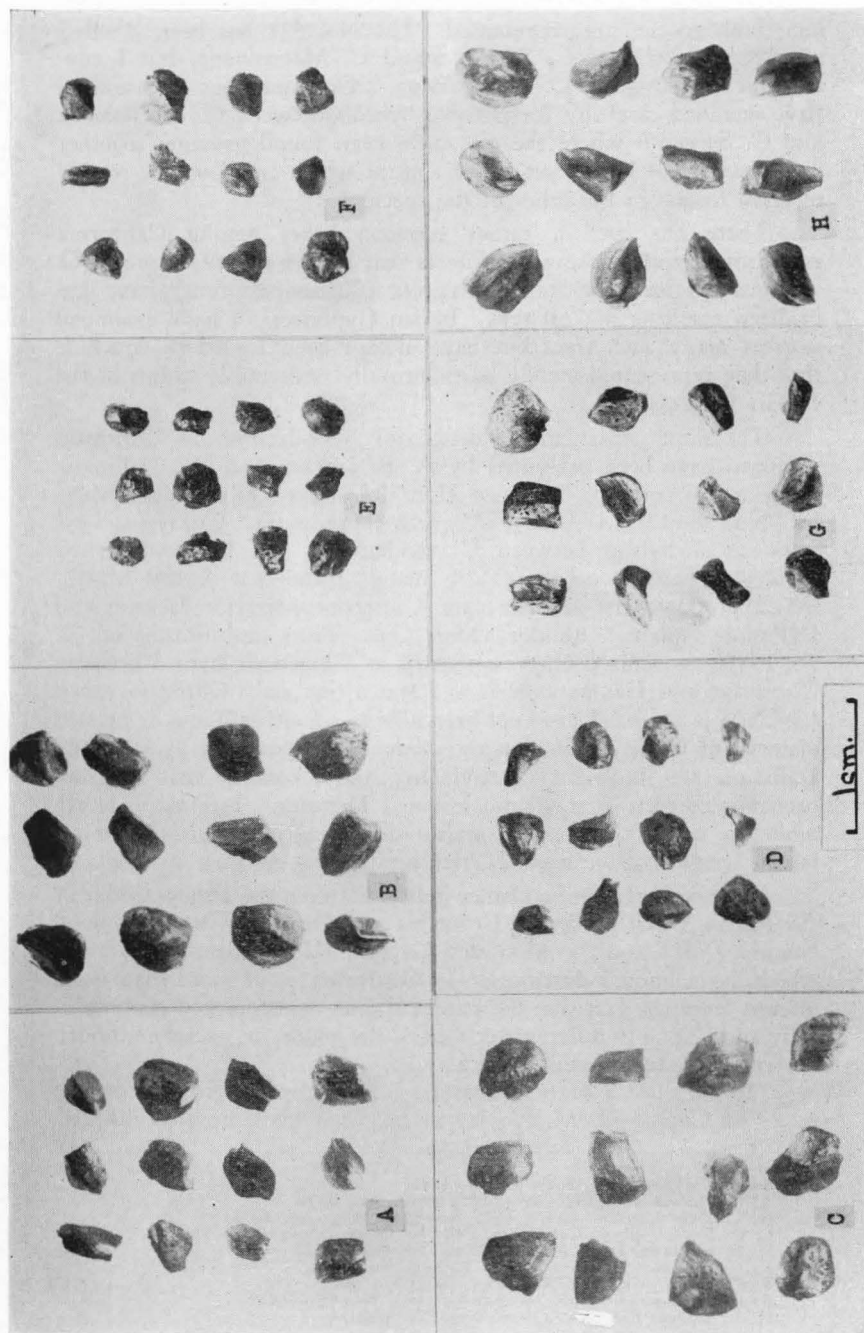


FIGURE 16. Seeds.

was received at Kew for identification. This specimen had the flattened fern-like sprays of *Cupressus nootkatensis*, but the cones were much larger, being up to $\frac{3}{4}$ inch in diameter, usually separating into eight scales, with about five tubercled seeds to each scale. A hybrid was at once suspected, the fruiting characters, as will be seen from the descriptions below, being exactly intermediate between the two species.

"*C. macrocarpa*. Cones 1-1 $\frac{1}{2}$ in. diam., 10-14 scales. Seeds about 20 on each scale, tubercled, 1/6 in. diam.

Hybrid. Cones $\frac{3}{4}$ to $\frac{3}{8}$ in. diam. Usually 8 scales. Seeds about 5 on each scale, tubercled, 1/5 in. diam.

C. nootkatensis. Cones $\frac{1}{3}$ in. diam., 4-6 scales. Seeds 2 on each side, non tubercled. $\frac{1}{4}$ in. diam.

"Captain Naylor and his forester, Mr. T. Alexander, have since kindly sent us further specimens from the same tree, which was raised in 1911 from seeds of a cone procured from a tree of *C. macrocarpa* growing about fifty yards from a specimen of *C. nootkatensis*. Two seedlings of this batch appeared different from the rest and were subsequently planted out. One of them, which is now 14 years old and has the habit of *C. nootkatensis*, is now 28 feet high and has borne cones. An instance of hybrid vigor is here seen, for a tree of *C. macrocarpa* from the same tree is only 21 feet high although it has received exactly the same treatment.

"Captain Naylor also states that his Uncle, Mr. C. J. Leyland, of Haggerston Castle, Northumberland, had in 1888 at Leighton Hall collected seeds from a tree of *C. nootkatensis* growing near one of *C. macrocarpa*, the latter standing to the windward of *C. nootkatensis*. From these he raised seedlings which were afterwards transferred to Haggerston. Among them were six which looked different from the rest, and one of these differed again from the others in habit, the foliage also being coarser. As they grew up it became evident that they were the result of a natural cross between the species named. These six trees were planted out in various positions, and the best of them is now growing on a lawn with other cypresses and has reached a height of 35 feet (Plate VII). The hybrid has thus arisen independently on two separate occasions.

"Specimens from two of the Haggerston trees, one of which bears numerous cones, have since been sent to us by Mr. Leyland. One

FIGURE 16.

Seeds of *Cupressus*. Photos July 7, 1945.

A. *C. macrocarpa*, Coll. No. 6233. Neg. No. 6041.

B. *C. guadalupensis*, J. T. Howell No. 8297. Neg. No. 6035.

C. *C. Forbesii*, Coll. No. 6282. Neg. No. 6029.

D. *C. lusitanica*, Prop. No. 2356. Neg. No. 6037.

E. *C. pygmaea*, Coll. No. 6176. Neg. No. 6047.

F. *C. Goveniana*, Coll. No. 6231. Neg. No. 6033.

G. *C. Abramsiana*, Coll. No. 6235 (type). Neg. No. 6021.

H. *C. Sargentii*, Coll. No. 6188. Neg. No. 6049.

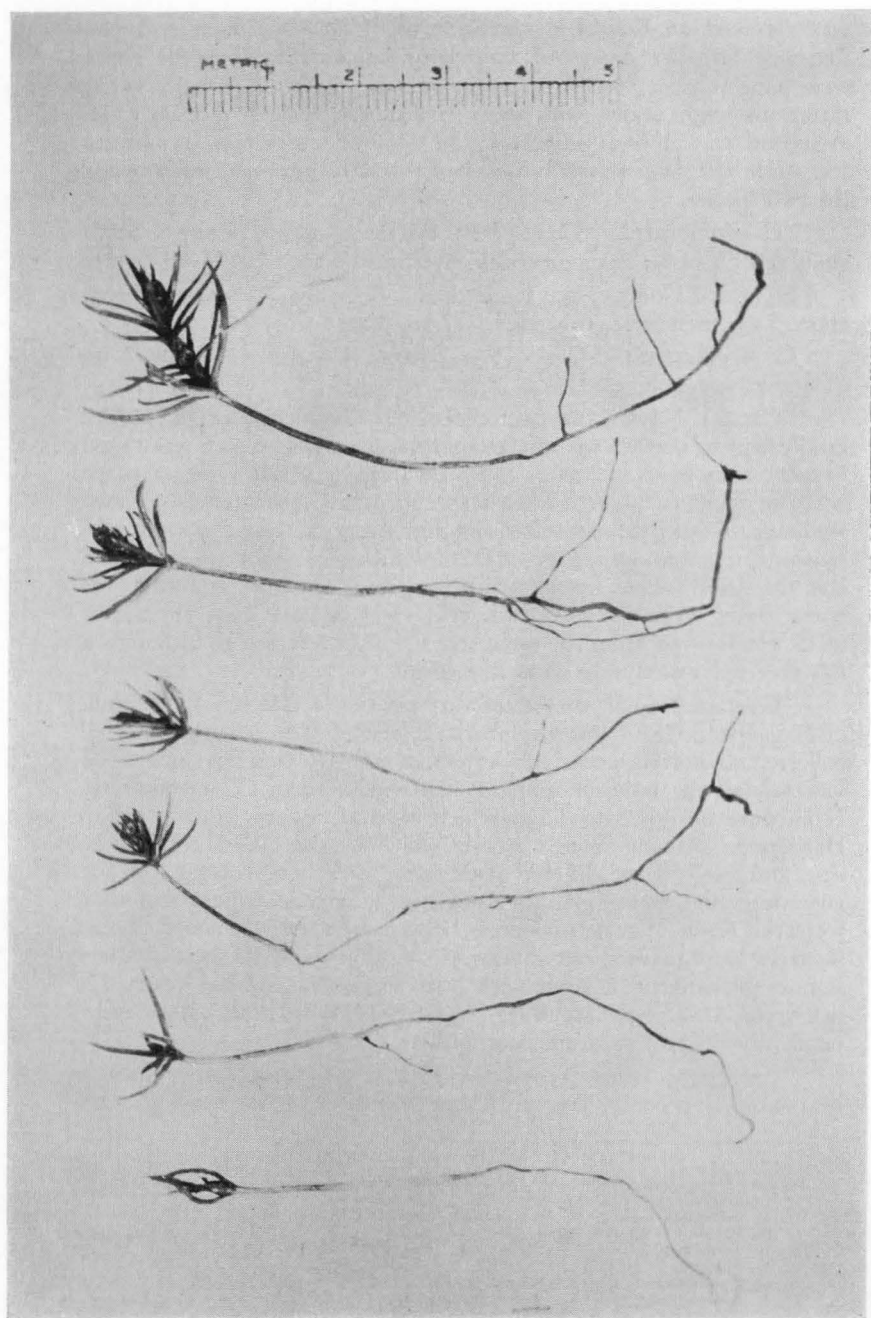


FIGURE 17. Seedlings.

exactly resembles in cones and foliage the later and reciprocal cross, the female parent in this case *C. macrocarpa* and the same tree as provided the pollen in the first cross. The other specimen, which has no cones, exhibits a slightly different arrangement of branchlets, which are set more or less at right angles to the shoot, and the tree shews a tendency to a more upright habit of growth like *C. nootkatensis*. Cuttings from the original hybrid strike freely and have been distributed to various gardens. We hope eventually to trace these, and study their characteristics. A group of twelve trees raised from cuttings was planted at Kyloe, seven on one side of the road and five on the other, as an anagram to Mr. Leyland's 75th birthday.

"It is important to add that both of these hybrids are fertile, seedlings of the F_2 generation having been raised; but as we have had no opportunity of studying them we cannot say if they shew signs of Mendelian segregation.

"Professor Henry informs me that he attempted to make an artificial cross, but without success. So far as we know there is no previous record of a hybrid *Cupressus*, though Mademoiselle Camus, the monographer of the genus, to whom we sent a specimen of the Leighton plant, thinks they may be less rare than is generally supposed. Most hybrid conifers which appear to be commonest in the genus *Abies*, have been artificially produced. Mr. M. H. Chapman has recently described a hybrid between *Pinus palustris* and *P. Taeda* which combines the characters of the two parents.

"As this new cypress has already been named *Cupressus Leylandii* by Mr. Leyland, we propose to describe it under that name:

"*X Cupressus Leylandii* Jackson & Dallimore hybr. nov.; (*C. macrocarpa* Hartw. *C. nootkatensis* Don.)

"Arbor, altitudine habituque ramulis et foliis complanatis *cupressi nootkatensis* similis Strobili globosi, usque ad 21 cm. diametro, squamis 8 instructi. Semina circiter 5 in squama quoque, complanata, late ovata, ala conspicua inclusa, tuberculis veluti in *C. macrocarpa*, circiter 5 mm. in diametro maxima.

"A tree similar in size and habit to *Cupressus nootkatensis*. Foliage with the flattened branchlet system of *C. nootkatensis*. Cones globose up to $\frac{3}{4}$ in. in diameter, separating into 8 scales. Seeds about 5 on each scale, flattened, including the conspicuous wing broadly ovate in outline, with tubercles like those of *C. macrocarpa*, about $1\frac{1}{5}$ in. in their widest diameter.

"Known only in cultivation.

"Miss Listé's careful and accurate drawings shew well the intermediate character of the plant."

FIGURE 17.

Seedlings of *Cupressus* preserved in pickling solution. *C. Forbesii* (Prop. No. 2330). Planted in nursery flat March 28, 1935; preserved May 30, 1935 (63 days after planting). The cotyledons (4 in each of these seedlings) are much larger than the early juvenile leaves. Photo July 12, 1945. Neg. No. 6216.

GENERIC DIAGNOSIS

Cupressus [Tourn.] L. Gen. Pl. ed. 5 435. 1754. [Tourn.] L. Sp. Pl. 1002. 1753. Evergreen trees, rarely shrubby; wood, bark, foliage and other parts more or less resinous. Bark of trunk fibrous, usually separating into long shred-like plates which are retained for many years; or partially to completely exfoliating annually in thin, curling, non-fibrous plates, leaving a smooth, polished, red-brown or mahogany-brown surface. Species with a straight central leader usually bear branches pointing upward, outward or even downward; while other species have a short main axis and several leaders often nearly vertical. Leaves opposite, small, of three sorts: 1). juvenile leaves linear, slightly flattened, bearing a minute spine or prickle and usually standing out rather sharply from branchlet; 2). normal leaves closely appressed to branchlet, acute, but blunt-pointed, seldom over 2 mm. long, often rigid or keeled on back and bearing a gland or pit which may be inconspicuous and non-functional, or conspicuous and exuding resin which is clear at first but soon turns whitish (sometimes apparently completely absent, even on some of the leaves of species whose leaves have active glands); 3). leaves on vigorous shoots become greatly elongated, often to 20 mm. and have a spreading, acute tip, which portion bears the gland when present. Staminate and ovulate cones borne on same tree on separate branchlets, although there are many trees in nearly every species which are, apparently, predominantly producers of staminate or ovulate cones. Staminate cones produced in abundance, maturing in one year from late fall to spring, often giving the individual tree a distinctly yellowish cast; these borne solitary at the tips of short branchlets; generally 3 to 5 mm. long, 2 to 3 mm. thick, somewhat cylindrical to 4-sided, composed of 10 to 20 triangular, opposite scales, each of which bears from 3 to 10 pollen sacs in an irregular row along its lower half, the margins of upper half ciliate (at least under a low power lens). Ovulate cones also produced at tips of short branchlets; and, although solitary, often appear to be in dense clusters when mature. These mature at the end of the second season, after which the cones open, shed their seeds rather promptly, or they may remain closed for several years, during which time many of the seeds remain viable. When first distinguishable, the ovulate cones appear as blunt, enlarged structures, scarcely different from the tips of vegetative shoots, are about 2 mm. thick, are composed of 6 to 12 scales which soon spread apart exposing the numerous ovules borne on the lower portion of the face of each scale; after pollination these scales close, gradually develop into a more or less globose cone, the scales of which become somewhat peltate, bear a horn or umbo on the exterior surface, and the margins which are

fimbriate become more or less fused. These cones seldom attain a diam. of more than 10 mm. the first season, sometimes remain green, but more frequently become glossy tan, brown, or even gray-glaucous. During the second season, the cones enlarge, usually become a dull brown or gray and attain a diam. of 10 to 45 mm. Ripe seeds numerous on all but the upper and lower pairs of scales, often over 100 per cone, 2 to 8 mm. long, very irregular in shape, but thickened in center and with a rather thin narrow wing; hilum usually visible, but conspicuous only if of a different shade than the brown, tan or black surface which may also be glaucous, and is frequently a little warty surfaced. Cotyledons 3 to 5, about 10 mm. long, linear, a little flattened, with an acute but blunt tip, and when first expanded after germination, stand at right angles to the main axis.

Type species: *Cupressus sempervirens* L. Sp. Pl. 1002. 1753. Italian Cypress. Native to southern Europe and western Asia, but widely cultivated in mild regions.

Cupressus is an ancient Latin word applied to the Italian Cypress, derived from the Greek word *kuparrisos*.

KEY TO NEW WORLD SPECIES OF CUPRESSUS

- A. Dorsal surface of mature leaves usually bearing a gland or pit, which may be inactive, but usually exudes a clear resin which turns gray or whitish upon drying. Foliage gray, glaucous gray-green, or dull, dusty-green, but never bright green. (Species of inland habitats.)B.
- B. Branchlets arranged in one plane, that is, forming flat sprays and somewhat "thuja-like". Bark of trunk rough and fibrous, not exfoliating, bark of branches similar or smooth gray but never exfoliating, leaving a smooth cherry-red or mahogany-brown surface. (Central and northern California in the Coast Ranges and Sierra Nevada foothills).....C. *Macnabiana* (p. 53)
- BB. Branchlets not arranged in one plane, but evenly or irregularly disposed on the branches. Bark of trunk either rough and fibrous or exfoliating in thin plates, leaving a cherry-red or mahogany-brown, smooth, polished surface; bark of branches exfoliating in thin, curling plates, leaving a smooth polished cherry-red or mahogany-brown surface.....C.
- C. Trees with slender branchlets less than 1.3 mm. in diam.; an open slender crown; staminate cones only 2 to 3 mm. long, composed of 6 to 10 scales (usually 8); ovulate cones 10 to 20 mm. in diam. (rarely to 23 mm.), usually conspicuously warty-surfaced; seeds mostly 3 mm. long (some 4 mm.), not at all glaucous. (Northern California and southern Oregon.).....2. C. *Bakeri* (p. 71)
- CC. Trees with branchlets usually over 1.3 mm. in diam., the crown more compact; staminate cones mostly over 3 mm. long, composed of 8 to 20 scales (usually 10 or more); ovulate cones rarely less than 20 mm. in diam. (mostly 25 to 30 mm.); sometimes a little warty-surfaced; seeds generally over 4 mm. long (mostly 5 mm.), glaucous or non-glaucous D.
- D. Trunks of mature trees with a rough, fissured, fibrous, gray or dark brown, non-exfoliating bark on at least the lower portion of the main trunk.....E.
- E. Ovulate cones opening soon after maturity (same fall or winter) and shedding their seeds which are strictly non-glaucous. (Sierra San Pedro Martir, Baja California) 3. C. *montana* (p. 93)
- EE. Ovulate cones usually remaining closed for several seasons after maturity; the seeds occasionally lightly glaucous F.
- F. Bark of branches, upper portion of the main axis, and that of saplings up to about 1.5 dm. in diam. exfoliating in thin, non-fibrous plates, leaving a smooth, cherry-red or mahogany-brown, polished surface; glands sometimes visible on only about one half of the leaves, not copiously exuding resin. (Southern Arizona, New Mexico, Texas and northern Mexico.)4. C. *arizonica* (p. 97)

- FF. Bark of branches and upper portions of main axis gray or red-brown, not exfoliating; trunks of some saplings under 5 cm. in diam. exfoliate, leaving a smooth red-brown bark; practically all leaves with a conspicuous and active gland. (Piute Mts., Kern Co., California.) 5. *C. nevadensis* (p. 117)
- DD. Trunks of mature trees with a smooth polished, cherry-red or mahogany-brown bark, this exfoliating annually in thin, curling, essentially non-fibrous plates, (rarely an old or over-mature tree fails to exfoliate its bark and numerous layers are built up) G.
- G. Seeds mostly over 5 mm. long, with a rather broad wing, surface not at all glaucous; glands of leaves comparatively inactive. (Cuyamaca Mts., San Diego Co., California.) 6. *C. Stephensonii* (p. 125)
- GG. Seeds mostly 4 to 5 mm. long, the wing generally not very broad, surface usually glaucous; glands of leaves generally very active. (Central Arizona) 7. *C. glabra* (p. 131)
- AA. Dorsal surface of mature leaves usually without an apparent gland or pit, sometimes present as an inconspicuous closed pit, or rarely a few are active and exude resin. Foliage either bright green, dark green, or rarely dusty-green or somewhat blue-glaucous, never a real gray H.
- H. Trees with graceful, drooping branches, which although composed of rather coarse branchlets are not harsh-foliaged; in aspect the trees are slightly blue-green; ovulate cones of the first season are densely white-glaucous and bear prominent horns or umbos, but at maturity are not at all glaucous, are rarely over 15 mm. in diam. and apparently open soon after maturity.* (Central Mexico, Guatemala, and Costa Rica.) 8. *C. lusitanica* (p. 147)
- HH. Trees with erect or stiff branches, bright green, dark green, or dusty-green, only glaucous in an occasional tree of *C. Sargentii* and this largely seasonal, or somewhat blue-glaucous in *C. guadalupensis*. Ovulate cones of the first season green to brown, never white-glaucous; at maturity usually over 15 mm. in diam. and remaining on trees and closed for several years I.
- I. Trunks and larger branches with a cherry-red or mahogany-brown smooth, polished bark, which exfoliates in thin, non-fibrous plates J.
- J. Foliage bright green to slightly dull green; mature trees usually less than 10 m. high; staminate cones with 10 to 14 scales; seeds not at all glaucous. (Mts. of Orange and San Diego Cos., California and Baja California.) 9. *C. Forbesii* (p. 159)
- JJ. Foliage bluish-green or sometimes glaucous, especially when young; mature trees usually over 10 m. high; staminate cones generally with 14 to 18 scales, seeds usually slightly glaucous. (Known only from Guadalupe Island, off west coast of Mexico.) 10. *C. guadalupensis* (p. 173)

*At least as cultivated by us under *Prop. No. 2356*.

- II. Trunks and larger branches with fibrous, non-exfoliating bark or if smooth (young trees and most branches) not at all cherry-red or mahogany-brown K.
- K. Foliage bright green or dark green, not at all dusty-green or glaucous; the dorsal pits of the leaves apparently absent in most instances, but when present never exuding resin L.
- L. Branchlets rather thick and harsh; staminate cones with central scales bearing 6 to 8 or even 10 pollen sacs; ovulate cones 25 to 35 mm. long, mainly longer than broad, the scales 8 to 12; seeds rich, dark, shiny brown, 4 to 6 mm. long, the nearly white hilum conspicuous. (Confined to two small groves on the coast of Monterey Co., California) 11. *C. macrocarpa* (p. 181)
- LL. Branchlets usually thin, not harsh; staminate cones with the central scales bearing not over 6 pollen sacs; ovulate cones mostly usually 20 mm. or less in diam., nearly spherical, the scales 6 to 10; seeds dull brown, slightly glaucous, or dull to shiny black M.
- M. Tree with a long, slender whip-like leader, and when in good soil growing to 30 m. in height, or dwarfed in sterile soil and producing ovulate cones when less than 1 m. high; foliage a deep, dark, dull, blackish-green; seeds shiny black or dull brown. (Coast of Mendocino Co., California.) 12 *C. pygmaea* (p. 195)
- MM. Tree with a compact pyramidal crown, or if sparse sometimes irregular, but without a long, whiplike leader, rarely, if ever, over 10 m. high; foliage a light, bright green or sometimes slightly yellow to dull green N.
- N. Ovulate cones usually 10 to 15 mm. long; the seeds dull brown to dull black (never shiny black or glaucous), the hilum inconspicuous. (Two localities on coast of Monterey Co., California) 13. *C. Goreniana* (p. 207)
- NN. Ovulate cones usually over 15 mm. long; the seeds dull brown and

usually a little
glaucous; the
hilum conspicuous.
(Santa Cruz Mts.,
California.) 14. *C. Abramsiana*
(p. 215)

KK. Foliage dull, dusty green, or rarely
a little glaucous; branchlets rather
thick and harsh; the dorsal pits of
the leaves usually evident, and in some
instances a few are active; seeds glau-
cous, sometimes very conspicuously so.
(Coast Ranges from Mendocino Co. to
Santa Barbara Co., California.) 15. *C. Sargentii*
(p. 223)

1. CUPRESSUS MACNABIANA—McNab Cypress

Cupressus Macnabiana Murr., Edin. New Phil. Journ. II. 1: 293. pl. 11. 1855. Small tree or often shrub-like, seldom over 10 m. high, usually with a much-branched crown broader than high, the several main branches of which usually arise less than 1 m. above the ground and are more or less equal, the main trunk rarely up to 1 m. in diam., it and the old principal branches covered with a gray furrowed fibrous bark 1 to 2 cm. thick. Young trees often retain their central leader for many years, but eventually through accident or because the laterals are more vigorous, the side branches become equal to or longer than the original leader. In age the branches spread out horizontally and frequently bend to the ground. In general aspect, the trees are a dull gray-green or even very gray late in the season, but frequently appear yellow-gray because of the profusion of the staminate cones which appear to be produced at any season of the year. The foliage is very fragrant, perhaps more so than any other species of North America. Branchlets of the season barely 1 mm. thick, 3 to 10 mm. long, these largely arranged in one plane and forming flat sprays 2 to 3 cm. long composed of 8 to 10 lateral branchlets, some of which are in turn branched in the same plane.* Leaves not closely imbricated, 1.5 mm. long, blunt-pointed or obtuse at apex, rounded on back, the dorsal pit very conspicuous, even on the youngest leaves, placed well above the middle of the back of each leaf and always active. On vigorous shoots the leaves may become as much as 5 to 10 mm. long and have a widely spreading tip which is more acute and upon which portion the pit is borne. The short branchlets bearing the staminate or ovulate cones have leaves much more closely imbricated than the vegetative branchlets. Staminate cones abundant, solitary on the tips of short branchlets; the cones 2 to 3 mm. long, 2 mm. thick, angular globose or even somewhat 8-faced because of the flat sides of the usually 8 scales composing the cones. Scales often nearly 2 mm. broad and bearing 3, 4 or 5 pollen sacs (the basal and upper pair usually bear but 3 sacs), these in a very irregular semi-circle on the lower half of each scale. Ovulate cones solitary and produced at tips of short branchlets, often very abundant on some branches, but never as abundant as the staminate cones. Ovulate cones first visible on the branchlets as slightly swollen tips about 2 mm. thick, the scales at first not greatly different from the adjacent leaves. During the first season, the cones rarely exceed 1 cm. in length, generally turn from green to a rich brown and are not only angular because of the rather irregular faces of the 6 or 8 scales, but also because of the rather pronounced and conical umbos. At maturity the cones are brown-

*Although this feature is occasionally found in certain other North American species, it is not common nor normal, and is known to us as a regular feature in only one other species (*C. funebris*).

ish or gray and remain unopened on the trees for many years, the seeds remaining viable for many years. The mature cones are seldom over 25 mm. long, usually a little less in diam., and the umbos are conical, point upward, outward or are even incurved and may be 2 to 4 mm. long. In extreme age the cones turn from dull gray-brown to dark gray, and the umbos become much less conspicuous, largely because they appear to weather away. Seeds vary from about 75 to 105 per cone, are irregular in shape and size, the smallest being only 2 mm. long, the largest nearly 5 mm. long, and are often equally broad, with a narrow thin wing, the surface of the body smooth or warty with minute pitch pockets, either light or medium brown or with a slightly glaucous-brown surface; the hilum is 1 to 1.5 mm. long, usually is inconspicuous and is almost as dark in color as the rest of the seed. Cotyledons 3, 4 or 5, but generally 4, linear and a little flattened, the tip blunt, 10 to 12 mm. long. The next leaves are borne in whorls of 4; the later are opposite, are similar to the cotyledons but are shorter, flatter and have a spine at the tip. These juvenile leaves are produced for about 2 years or sometimes longer, after which the branchlets gradually produce transitional leaves bearing dorsal pits, then a little later the mature type only is produced.

Type Locality

"Habitat in California circa lat. 41° Bor." Murr., Edin. New Phil. Journ. II. 1: 293. 1855. Some authorities have concluded that the original specimens came from the vicinity of old Shasta City in Shasta County from the grove at Whiskytown (i.e. Abrams, Ill. Fl. Pac. States 1: 73. 1923). This may well be true, for no cypresses have ever been discovered on Mt. Shasta, and exact geographical localities did not seem so important in the early days. The type specimen was collected by William Murray, brother of Andrew Murray, who described it and stated: "My brother has named this species after our friend Mr. M'Nab, of the Royal Botanic Garden, Edinburgh, who contributed much to the success of the expedition."

Range

United States. California. Found at scattered localities in the Sierra Nevada foothills from Aukum, Amador County, to Magalia, Butte County, and at Kennett, Shasta County (on the Sacramento River); thence, south in the Coast Ranges beginning at Whiskytown, Shasta County, and the Trinity River, Trinity County, and jumping south to Lake County, Napa County and to the head of Hooker Canyon, Sonoma County (the southernmost Coast Range station).

These stations are all typical Upper Sonoran Life Zone and are in dry areas, usually associated with *Pinus Sabiniana* or with chaparral

species such as *Ceanothus cuneatus* and *Arctostaphylos viscida*. The soils are largely coarse and rocky and are frequently serpentine, but the species has been found in clay soils. In most instances, the stations are individual isolated groves, and there are no known trees in the intervening areas. However, in Lake and Napa Counties, the species is not thus confined and occurs much more widespread as solitary or scattered trees often in association with *Cupressus Sargentii*. In view of the dry areas within which this species grows, it is safe to state that probably no other North American species of *Cupressus* grows under more trying conditions. The rainfall at all stations is probably not much over 20 inches per year, except at Whiskytown and Kennett where it may be 35 inches or more. The summer months are hot and dry with temperatures frequently well over 100 degrees F. Only upon rare occasions does any rain fall during the period from May until late September, and it is doubtful if the occasional summer showers wet the soil sufficiently deep for the cypress roots to derive any benefits. Fires appear to be responsible for the destruction of many stands of this species, and although large quantities of seeds are usually released as a result, the seedlings seldom form the dense thickets so common in some of the other species. Old or over-mature trees are rarities and are probably best seen at Aukum, Whiskytown and in the vicinity of Aetna Springs, Napa County.

Many of the localities for this species cited by Sudworth in his Forest Trees of the Pacific Slope have been carefully checked, and at least several appear to have been based upon stands of *Juniperus californica*.

When the rather wide range of this species is considered along with the comparative isolation of the individual stations, it is a bit strange that the plants are so remarkably uniform in their essential features. True enough, there is considerable variation in growth habit, but when one considers the role of fire which has resulted in different-aged stands and the variation in climate and soil throughout the range, there are certain gross variations. Even in the cultivated progenies from the various groves there has been little variation, a discussion of which is given under the horticultural section, and which indicates that from many standpoints *Cupressus Macnabiana* is, perhaps, the least variable of all the species whose distribution is not restricted to a single station or grove.

Localities

1. Aukum, Amador County. This is the southernmost known station for *Cupressus Macnabiana* in the Sierra Nevada foothills, and in latitude is only a few miles north of the southernmost known station in the Coast Ranges, located in Hooker Canyon, Sonoma County. The grove is situated on what is known locally as "Red

Hill", but this name does not appear on any maps and "Red Hills" are about as common in California as "Willow Creeks". However, the hill is in Township 9 North, Range 11 East, Mount Diablo Meridian, and can be reached by driving slightly northeast from the town of Plymouth to a little place called Oleta and shown on some maps. From Oleta there is a dirt road leading north to Aukum. In October, 1934 there was one ranch house along this road. After passing it the road leads off to the northwest a bit and ascends the hill mentioned above as "Red Hill". From near the summit of this hill, a short walk to the northwest enables one to reach the cypress trees. The area is approximately 2000 ft. in elevation and has a rocky red clay soil. It is typical Upper Sonoran Life Zone with *Pinus Sabiniana* as the principal other tree, but there are a few stray *Pinus ponderosa*, but they do not form a forest in this area until higher elevations are reached. The two main shrubs are *Arctostaphylos viscida* and *Ceanothus cuneatus*. The rocky clay soil supports very little growth of annuals; and, as a result, the cypress seedlings are not choked out. This grove is one of the few for this species which does not appear to have been swept by fire in many years; and, as a result, there are many over-mature or decadent trees. These serve as an indication of the extreme size, age and general appearance to which this species is capable of developing. These old trees are certainly not beautiful, even though they may be considered picturesque with their straggly crowns, sparse foliage, roughened trunks and numerous dead branches. The largest trees noted in this area were probably not over 13 m. high, had a spread of about 12 m. and trunk over 1 m. in diam. at the ground level. A few trees of large size had fairly straight central trunks; but, for the most part, they branched near the ground and produced numerous main branches resulting in a rather rounded crown.

By driving into this area from Plymouth along the road to Aukum, it is possible to see this grove of cypress by looking to the southeast just before reaching Aukum, but none of the trees is close to the road.

Collections:

- a). C. B. Wolf and E. R. Johnson, Coll. No. 6144 (Prop. No. 2111, our Aukum No. 1 Strain), October 2, 1934, from a tree about 13 m. high, 12 m. spread and a trunk over 1 m. in diam. at the ground, but only 1 m. at 1 m. above the ground; this tree was heavily laden with cones, had sparse foliage, a very dark gray or nearly black rough bark and was obviously over-mature.
- b). C. B. Wolf and E. R. Johnson, Coll. No. 6145 (Prop. No. 2112, our Aukum No. 2 Strain), October 2, 1934, from a tree 10 m. high, 10 m. spread, and a trunk 5 dm. in diam. at the ground, but at slightly over 1 m. above ground branched into numerous main

branches and formed a well rounded crown. This was a vigorous tree and in no way suggested by its foliage that it had passed its prime or was over-mature.

2. Grass Valley, Nevada County. This is the second locality in the Sierra Nevada foothills for *Cupressus Macnabiana* and is roughly about 50 miles to the north of the Aukum grove. As far as is known, no cypresses grow between these two stations. The Grass Valley Grove is located along the road between Grass Valley and Nevada City at approximately 1 mile above Grass Valley. A few individuals are east of the road, but the main stand extends over an area of at least one-half a mile to the west of the road. No real trees appear to be present in this entire area, the largest being less than 5 m. in height. They branch very close to the ground and spread out so that their slender branches make a crown much broader than high. The area is typical Upper Sonoran Life Zone with a chaparral cover of *Arctostaphylos viscida*, *Eriodictyon californicum* and *Pickeringia montana* as the conspicuous shrubs. The soil is a bluish rock (probably serpentine), and there is little other growth except woody plants upon it. The approximate elevation is 2600 ft., with the principal slopes being south and west. It is probable that the trees in this stand of cypresses represent a second or even third generation since the early mining days; for none of the individuals appears to be over-mature, and there are indications that fires have gone through this area in the past. Portions of this area are used for dumping tin cans and other rubbish, so that fires are likely to be rather common; and, for this reason, it is quite possible that seedlings will have a difficult time, and that the grove may eventually become extinct.

Collections:

a). C. B. Wolf and B. D. Stark, Coll. No. 5496 (Prop. No. 1959), September 24, 1933, from a plant 5 m. high, 8 m. spread and a trunk 2 to 3 dm. in diam.; b). C. B. Wolf and E. R. Johnson, Coll. No. 6148 (Prop. No. 2114, our Grass Valley No. 1 Strain), October 3, 1934, from a tree 3 m. high, 5 m. spread and a trunk 2 dm. in diam.; c). C. B. Wolf and E. R. Johnson, Coll. No. 6149 (Prop. No. 2115, our Grass Valley No. 2 Strain), October 3, 1934, from a tree 2.5 m. high, 8 m. spread and a trunk nearly 4 dm. in diam.; this was an interesting specimen in that the branches were very much spreading at a little more than a meter above the ground, but practically all the larger ones touched the ground near their tips.

3. Texas Hill, Yuba County. The next grove to the north is on Texas Hill, Yuba County. This is a small hill along the road approximately 2 miles west of Dobbins. Some of the trees

are adjacent to the north side of the road, so it would be difficult to miss them in following this road west from Dobbins. The cypress trees now occupy only a few acres. It appears that the grove may have once been much larger, but a recent firebreak, fires and cutting for fence posts have reduced it greatly. The grove seems to be an Upper Sonoran Life Zone "Island" in the lower edge of the Yellow Pine Belt (Arid Transition Life Zone) and is in sterile, rocky granitic soil. Shrubs in the adjacent areas are *Haplopappus arborescens*, *Rhamnus rubra* subsp. *obtusissima* and *R. californica* subsp. *tomentella*. Elevation approximately 1800 ft.

Collections:

a). C. B. Wolf and E. R. Johnson, Coll. No. 6151 (Prop. No. 2116, our Texas Hill No. 1 Strain), October 3, 1934, from a tree 6 to 7 m. high, 8 m. spread and a trunk 4.5 dm. in diam.; b). C. B. Wolf and E. R. Johnson, Coll. No. 6152 (Prop. No. 2117, our Texas Hill No. 2 Strain), October 3, 1934, from a tree 6 m. high, 8 m. spread, and a trunk 5 dm. in diam. at the ground, then immediately branching into two trunks each 4 dm. in diam.

4. Indiana Creek, Yuba County. The Indiana Creek grove is almost due north from the Texas Hill station and is not over 5 miles airline from it. It may well be that in the not too distant past these two groves were continuous. Indiana Ranch on Indiana Creek is approximately 3 miles north of Dobbins on the road to Challenge. A side road leads down to the west along Indiana Creek, and at about 1.7 miles from Indiana Ranch the cypresses come down to the road near the creek. The area occupied by the cypresses is roughly only about 300 ft. in width, but extends up the hill to the north for about one-half a mile and consists of several hundred trees. The trees are all on this rocky south slope, and in the area are *Pinus Sabiniana* and *Quercus Wislizenii*. Elevation approximately 1800 ft. A conspicuous feature of the trees of this grove was the presence of great quantities of *Phoradendron densum* Torr. on many of the trees.

Collections:

a). C. B. Wolf and E. R. Johnson, Coll. No. 6156 (Prop. No. 2118, our Indiana Creek No. 1 Strain), October 4, 1934, from a tree nearly 6 m. high, 6 m. spread, a flat top and a trunk 2.5 dm. in diam.; b). C. B. Wolf and E. R. Johnson, Coll. No. 6157, (Prop. No. 2119, our Indiana Creek No. 2 Strain), October 4, 1934, from a tree 5 m. high, 7 m. spread and a trunk 4 dm. in diam., but branching close to the ground, and with rather large cones with short umbos.

5. Magalia, Butte County. The Magalia locality for *Cupressus Macnabiana* is approximately 30 miles north-northwest of the Indiana Creek Station. The cypresses at Magalia (a little

town of the Sierra foothills east of Chico) are confined to an area between the railroad and the Magalia Reservoir Dam, an area not more than one-fourth of a mile in extent. The soil is a bright green serpentine (one of the most beautiful deposits of this rock to be found anywhere in California, and which the local people have used for surfacing roads). Growing with the cypresses is *Pinus Sabiniana*, but the surrounding hills are clothed with *Pinus ponderosa*, so that the area is in reality an Upper Sonoran Life Zone "Island" in the Lower Arid Transition Life Zone. The elevation is approximately 2300 ft. The cypress trees in this area are thrifty and healthy in appearance, possibly because rainfall is greater than at many other stations, and because the summer temperatures are not so high. It is likely that the trees in this grove, which number only a few hundred at the most, will survive for many years since they are reasonably well protected from fires by the roads, but they might all be cut out if extensive use were to be made of the serpentine deposit.

Collections:

a). C. B. Wolf and E. R. Johnson, Coll. No. 6160 (*Prop. No. 2121*, our Magalia No. 1 Strain), October 5, 1934, from a tree 4 m. high, 8 m. spread and a trunk 3 dm. in diam., the branches bending down then turning upwards; b). C. B. Wolf and E. R. Johnson, Coll. No. 6161 (*Prop. No. 2122*, our Magalia No. 2 Strain), October 5, 1934, from a tree 4 m. high, 6 to 7 m. spread and a trunk 4 dm. in diam. at the ground but branching into 3 main forks very close to the ground.

6. Kennett, Shasta County. R. Bacigalupi 2386, May 29, 1934 (*Dudl. Herb.*), from "Along road off U. S. 99, leading to Kennett at summit of grade down the Sacramento River Canyon, Shasta Co." This is the northernmost known station for this species.

7. There are several other localities cited by Sudworth in his *Trees of the Pacific Slope*. These are for the country east of Red Bluff, but despite the preciseness of some of the localities as to exact Section etc., we found that some of them were stands of *Juniperus californica*, so that unless actual specimens are to be had or additional field studies carried on, we shall have to eliminate these from consideration.

8. Whiskeytown, Shasta County. The grove of *Cupressus Macnabiana* at Whiskeytown is thought by many to be the original one from which the type specimens were obtained. This locality is in the foothills of the Inner North Coast Ranges and is approximately 1 mile east of the old town of Whiskeytown, which is now listed on some maps as Schilling. Whiskeytown is at the junction of Whisky Creek and Clear Creek and is about 5 miles west of

the now historic mining town of Old Shasta. These spots are on United States Highway No. 299 from Redding to Weaverville. The grove of *Cupressus Macnabiana* seems to be confined to the north side of Clear Creek at an elevation of about 1000 ft. and consists of several thousand trees. Associated with the cypresses in a sterile nearly white rocky soil are *Pinus attenuata*, *Quercus Wislizenii* and *Arctostaphylos viscida*, the latter being one of the dominant shrubs over great areas of the entire foothill section at the head of the Sacramento Valley.

The climatic conditions at Whiskytown are considerably different from those at most of the Sierran localities as well as those of the Coast Ranges to the south. Redding, which is less than 10 miles to the east, often receives over 35 inches of rainfall during the winter months, while in summer the temperatures frequently go above 100 degrees F. day after day. Whiskytown, because of its higher elevation than Redding, may not have quite such high summer temperatures but probably receives at least as much rainfall.

Many of the cypress trees at Whiskytown appear to be nearing maturity, suggesting that it has been many years since a fire has done any considerable damage in this area.

Collections:

a). E. R. Johnson, Coll. No. 1183 (Prop. No. 449), August 30, 1928; b). C. B. Wolf, Coll. No. 2383 (Prop. No. 1256), August 31, 1931, from a tree 10 m. high, 10 m. spread and a trunk nearly 4 dm. in diam.; c). C. B. Wolf and E. R. Johnson, Coll. No. 6164 (Prop. No. 2125, our Whiskytown No. 1 Strain), October 6, 1934, from a tree 7 m. high, 6 m. spread and a trunk over 3 dm. in diam.; d). C. B. Wolf and E. R. Johnson, Coll. No. 6165 (Prop. No. 2126, our Whiskytown No. 2 Strain), October 6, 1934, from a tree 9 m. high, 8 m. spread and a trunk 4 dm. in diam.; e). C. B. Wolf, Coll. No. 11474 (Prop. No. 5047), October 28, 1944. This collection represents a series of specimens, each from a different tree. At the time this collection was made, I made the following field notes: "The entire area where this species grows here was carefully explored. There are several thousand trees. Stumps of old, large trees show that many have been taken for wood, etc. in the past, and that most trees now alive are not mature. In a few spots I noted thickets of small trees with trunks 1 to 2 inches in diameter—otherwise no small seedlings. Apparently it reproduces extensively after fires—of which none here recently. The cones remain unopened for many years; new 1-year cones are bright brown; old ones gray, dull-brown. Trees gray in aspect, or yellow because of staminate cones shedding pollen now."

9. Trinity River, at Betty May Mine, Trinity County, L. B. Kildale 10276, Oct. 19, 1930 (Dudl. Herb.). This is, perhaps, the

most northwesterly known station.

10. Hough Springs, Lake County. The Hough Springs locality for *Cupressus Macnabiana* is about 90 miles airline south of Whiskytown; and, as far as is known, there are no stands of this species between the two. Hough Springs is on the road from Bartlett Springs to Williams. After leaving Bartlett Springs, the road follows down along Bartlett Creek past Hough Springs (elevation 1950 ft.) and then up Stanton Creek, which is a fork of Cache Creek; the Lake County—Colusa County line is near the summit of this grade. The cypress trees are most abundant about 7 miles east of Hough Springs, but there are also a few along Bartlett Creek at about 5 miles east of Bartlett Springs. This entire area of the Inner North Coast Range is marked by a scattered forest of *Pinus Sabiniana*, *Pinus attenuata* and *Cupressus Sargentii* over a basic chaparral growth in which *Quercus dumosa* and *Q. durata* are very abundant. Other shrubs in this area are *Garrya Congdonii*, *Ptelea Baldwinii* var. *crenulata* and *Styrax officinalis* var. *californica*. Although this region probably receives 20 to 25 inches of rainfall many years, its close proximity to the Sacramento Valley and its great distance from the ocean make it a hot and dry region during the summer months. Temperatures of over 100 degrees F. are not uncommon throughout the hottest part of the summer, while during the winter, temperatures of 20 degrees F. are not unusual. In seasons of deficient rainfall, the fruits of such common plants as *Rhamnus californica* subsp. *crassifolia* dry up on the bushes when only partially mature. The hillsides are largely serpentine rock formation, and the entire region is high in alkaline salts, and in late summer the beds of all the creeks are whitened by the salts remaining as the water has evaporated. An indication of the extreme concentration of salts in the waters of these creeks in late fall is that in October, 1934 water from a fork of Cache Creek, used for camp purposes, would not produce a lather regardless of how much ordinary soap was used, but instead the soap formed curds very much as if sour milk had been poured into the water.

The region from Bartlett Springs to the Colusa County line has been swept by fires many times, and there is every reason to believe that there were many more cypresses, not only of *C. Macnabiana*, but also of *C. Sargentii* in this area in the past. Both species are highly inflammable. The rough country to the north of the Bartlett Springs to Williams road, particularly as far as the Colusa County line, is made up of rugged hills with practically no roads, and so it has been impossible to determine readily if *Cupressus Macnabiana* extends more than just a short distance north of the road.

Collections:

a). C. B. Wolf, No. 2059, May 6, 1928, 5 mi. east of Bartlett Springs on road to Williams; b). C. B. Wolf and B. D. Stark, Coll. No. 5509 (Prop. No. 1970), September 26, 1933, from 5 mi. east of Bartlett Springs on road to Hough Springs, along Bartlett Creek, near its bank in rocky soil, a tree 10 m. high, 5 m. spread and a trunk 3 dm. in diam.; c). C. B. Wolf and E. R. Johnson, Coll. No. 6187 (Prop. No. 2144, our Hough Springs Strain), October 14, 1934, from 7 miles east of Hough Springs or 3 miles west of Lake-Colusa County line at about 2000 ft. elevation, a tree 6 m. high, 5 m. spread, and two trunks, one 2 dm., and the other 1.5 dm. in diam., growing in serpentine with almost equal numbers of *Cupressus Sargentii* and *Pinus Sabiniana*.

11. Reiff, Lake County. East of Reiff P. O., Lake County at a point about 1 mile west of the Lake-Napa County line is another area in which *Cupressus Macnabiana* is plentiful and continuous to Knoxville, Napa County. This locality is approximately 30 miles south of the Bartlett Springs-Hough Springs area, and in the intervening hills which are not easily traversed there are, no doubt, scattered stands of *Cupressus Macnabiana* and *C. Sargentii*. The Reiff area is much the same sort of country as that described around Hough Springs, with the hillsides covered with a chaparral growth of *Adenostoma fasciculatum*, *Quercus durata* and *Q. dumosa* and scattered trees of *Pinus Sabiniana*. Here too, there are scattered specimens of *Cupressus Sargentii* growing side by side with those of *Cupressus Macnabiana*; but, in no instances, was it difficult to distinguish the two. Almost without exception, the trees of *C. Sargentii* have a straight slender trunk and are higher than broad, while in *C. Macnabiana* the trunk branches into several forks close to the ground, and the crown is broader than high. In this area *C. Macnabiana* is more or less continuous for several miles, that is from near Reiff to Knoxville, Napa County.

Collection:

C. B. Wolf and E. R. Johnson, Coll. No. 6192 (Prop. No. 2148, our Reiff Strain), October 16, 1934, from 1 mile west of Napa County line, from a tree 8 m. high, 10 m. spread and a main trunk 4 dm. in diam.

12. Aetna Springs, Napa County. Aetna Springs, Napa County is about 17 miles south of the Reiff locality and is just 10 miles east and a little south of Mt. St. Helena. There are numerous *Cupressus Sargentii* in the hills near Aetna Springs, but only a few more or less isolated individuals of *C. Macnabiana* were noted along the roadside about a mile east of the springs (October, 1934). No collections were made, since at the time propagation material was desired and practically no cones were present.

13. Pieta Road, Lake County. Pieta Road, Lake County leads across the Coast Ranges from Hopland to Kelseyville by way of Highland Springs. About 4 miles west of (above) Highland Springs on the head of Adobe Creek is an extensive area of *Cupressus Macnabiana*. It is of interest to note that a heavy black adobe soil covers the serpentine rocks in this area, and that the cypress trees seem to thrive in it. Many of the trees resemble well-rounded old apple trees in their outline and low crotch. The area is situated at about 2000 ft. in elevation and is characterized by numerous oaks such as *Quercus dumosa*, *Q. durata* and a few *Q. lobata*. There are also considerable stands of *Cupressus Sargentii*, which are mostly a short distance to the west at a little higher elevation.

C. B. Wolf and E. R. Johnson, Coll. No. 6186 (Prop. No. 2143, our Pieta Road Strain), October 14, 1934, from a tree over 7 m. high, 10 m. in spread and two trunks rising from just above the ground surface, these 2.5 and 3 dm. in diam. respectively. In this collection the umbos were prominent or conspicuous only on young cones.

14. Red Mt., southeastern Mendocino County. There are many Red Mountains in California, and several in Mendocino County; the one referred to here is five or six miles southeast of Ukiah.

Collections:

James McMurphy 668, 669 & 670, Aug. 3, 1909 (Dudl. Herb.); No. 672, (Dudl. Herb.) by the same collector and the same date was said by him to be a hybrid between *C. Macnabiana* and *C. Sargentii*, but I regard it as the former species.

15. Hooker Canyon, Sonoma County. The Hooker Canyon station for *Cupressus Macnabiana* is the southernmost known locality for this species and lies approximately 30 miles south of the Aetna Springs area. It is also slightly south of the Aukum station in the Sierra Nevada foothills of Amador County. The Hooker Canyon stand of cypresses is approximately at the summit of the grade and is above (east of) a place called Cavedale. The Hooker Canyon road turns off of the California State Highway Number 12 about one-half way between Sonoma and Kenwood, and the cypresses are about 4.7 miles northeast of this point. The area is typical chaparral slope of *Adenostoma fasciculatum* and *Quercus dumosa* with most of the old cypress trees burned off, some rather recently, with their blackened stumps still standing. However, scattered through the brush are many young cypress trees all of which are growing in a porous gray volcanic rock at an approximate elevation of 1800 ft.

Collection:

C. B. Wolf and E. R. Johnson, Coll. No. 6198 (Prop. No. 2154, our Hooker Canyon Strain), October 18, 1934, from a tree 5 m. high, 5 m. spread and a trunk 2 dm. in diam.

Many additional stations for *Cupressus Macnabiana* could probably be cited for the Lake and Napa County area; for, like *C. Sargentii*, the species is scattered over many of the hills which are not easily reached. However, the above mentioned stations of this region are typical examples of places where the species grow. Some additional collections from spots which I have not visited are:

a). J. P. Tracy No. 14006, (R. S. A.), July 4, 1935, 2700 ft. elevation, from a tree 10 m. high and a trunk 3 dm. in diam., from Cobb Mountain, Lake County, on the north side of Cobb Valley near Glenbrook, in chaparral in red volcanic soil; b). J. W. Blankenship, September 16, 1928 (R. S. A.), from Siegler Springs, Lake County.

Additional stations for the Sierra Nevada foothills are:

"There is a station for McNab cypress (*Cupressus Macnabiana* Murr.) about one-half mile west of the junction of the Alcade mine road with the McCormick road to Indian Spring, Nevada County. It also occurs in one locality between Nevada City and Grass Valley.—A. E. Wieslander, Nov., 1927." Madroño 1: 186. 1928.

See also Madroño 2: 31. 1931, in which localities for *C. Macnabiana* and *C. Bakeri* are confused.

Collections of Cultivated Specimens

a). P. C. Everett, Coll. No. 7784, May 19, 1936, seedlings of Prop. No. 2111, from 4 in. pots in Garden nursery, seed flats planted March and May, 1935; 12 and 15 cm. high, juvenile leaves mostly less than 4 mm. long, transitional and mature types already produced, on which active dorsal glands present, which are visible without a lens; flat, thuja-like branchlet system evident at this early stage; remains of some cotyledons still present; root system fairly well developed. b). P. C. Everett, Coll. No. 7793, May 19, 1936, seedlings of Prop. No. 2144, from 4 in. pots in Garden nursery, seed flats planted March and May, 1935; 4, 5, and 6 cm. high, juvenile leaves mostly less than 4 mm. long, transitional types already produced, and with visible, active dorsal glands, but no mature type leaves evident, cotyledons still present; root system very well developed in proportion to top. c). Thornton T. Munger, No. 2, December, 1939, (R. S. A.), from a tree about 3 m. high, of equal spread, cultivated at the Wind River Experiment Station, Skamania County, Washington. Said by Mr. Munger to have been grown from seeds supplied by the D. Hill Nursery in 1913. The photograph supplied by Mr. Munger and mounted with the

herbarium specimen shows the typical shrubby growth of this species.

Relationships

Cupressus Macnabiana occupies a unique position among the North American species of *Cupressus* in that there is no real problem as to its close relatives. Its thuja-like or plicate branchlet arrangement is found only in other species as an abnormality on some branches and is not a regular feature. Its glandular foliage is not unusual in that many species have active dorsal pits. The characteristic broad crown and general lack of a permanent central leader are important features. *Cupressus Bakeri* and *nevadensis* have at various times been regarded as varieties or synonyms of *Cupressus Macnabiana*, but neither appears to be even closely related to it, especially when the growth habit, central leader and somewhat reddish bark as well as the different foliage of the two are considered. The somewhat similar flat sprays of *C. funebris* (Asiatic species) are not regarded as indicating relationship with *C. Macnabiana*, but are regarded as merely parallel development of characters.

References*

CUPRESSUS M'NABIANA Murr., Edin. New Phil. Journ. II. 1: 293. pl. 11. 1855. Note the original spelling by Murray, but which has generally been altered to *Macnabiana* in later works. Original description, for quotation see Type locality in text. 2). Gord. & Glend., Pinet. 64. 1858. *C. glandulosa* Hook. and *Juniperus Macnabiana* are cited as synonyms. According to these authors, "it was first discovered by Mr. Jeffrey on the Shasta Mountains, in northern California, in lat. 41°, at an elevation of 5000 feet, and afterwards by Mr. Murray in the same country, who transmitted seeds to Messrs. Lawson." They also state: "This beautiful cypress is perfectly hardy and must not be confused with a more slender and less ornamental kind, substituted for it by an importer of Californian conifers." Perhaps, the latter kind referred to was *C. Sargentii* Jepson. 3.) Parl., in DC. Prod. 16: 473. 1864. The collections of Jeffrey and Murray are cited. *C. glandulosa* Hook. ex Henk. et Hochst. is listed as a synonym. 4). Engelm., in Brew. & Wats. Bot. Calif. 2: 114. 1880. "About Clear Lake (Torrey, Bolander); originally reported by Jeffrey from Mt. Shasta at 5000 feet altitude." 5). Lemm., West Am. Conebearers 3rd ed. 77. 1895. 6). Sarg., Silva No. Am. 11: 109. Tab. DXXVIII. 1896. Synonyms cited

*These references, and those for the other species, are listed under the names which the various authors used except that minor variations in spelling are not ordinarily indicated. In as far as possible, I have attempted to correlate and evaluate the major number with my own treatment.

are: *C. glandulosa* Henk. et Hochst., *C. californica gracilis* Nelson, and *C. Nabiana* Mast. The plate shows the flattened arrangement of the branchlets of this species. 7). Mast. Journ. Linn. Soc. 31: 347. 1896. Synonyms cited are: *C. nivalis* Lindl. Mss., *C. glandulosa* W. Hook. Mss. and *C. Coulteri*, Hort. Glasnevin. 8). Eastw., *Zoe* 5: 11-13. 1900. This short article presents notes on *Cupressus Macnabiana* and several points are stressed. The most important is that the species, although originally said to have been collected at the southern base of Mt. Shasta has not been found there since, and that according to Dr. C. Hart Merriam (Biol. Surv. Mt. Shasta, No. Am. Fauna 16: 138. 1899) the term "Shasta" was rather loosely applied. Miss Eastwood also points out that *C. Macnabiana* is generally associated with *C. Goveniana* (her *C. Goveniana* is *C. Sargentii* as delimited in this paper). She also states that Carl Purdy thinks the two seem to intermingle (by inference hybridize) on Red Mountain, Mendocino Co. However, in my studies of specimens from that region, I have not seen any material which could not be placed either in *C. Macnabiana* or *C. Sargentii*. 9). Jepson, Fl. West. Middle Calif. 25. 1901. 10). Lemm., Sierra Club Bull. 4: 116. 1902. 11). Jepson, Field Book 13: 96. Sept. 5, 1905. Through the courtesy of Dr. W. L. Jepson, I have examined his notes on the type specimen which he made at the Edinburgh Royal Botanical Garden which, in effect, are: collected by Andrew Murray, dated 1856; the specimen is a branch only with rather fine branchlets with small leaves bearing distinct resinous dots. In discussing this with Dr. Jepson on February 26, 1943, it was concluded that the cones had probably been used for propagation purposes. 12). Brit., No. Am. Treces 100. Fig. 76. 1908. 13). Sudw., For. Trees Pac. Slope 165. 1908, in part. Some of the localities cited are for *C. Bakeri typica* or *Matthewsii*, while others appear to have been based on reports of *Juniperus*, for I have personally gone to some of the localities which are listed as to township and section; and which, to my thinking, could never have had cypresses. 14). Jepson, Fl. Calif. 1: 61. 1909. 15). Beissn., Handb. der Nadelh. 2: 578. 1909. *C. glandulosa* Hook. and *Juniperus Macnabiana* Laws. Cat. ex Gord. are listed as synonyms. 16). Jepson, Silva Calif. 160, 1910, in part, except for the Seiad Creek reference. "Carl Purdy tells me that on Red Mountain in southeastern Mendocino County there is an area of Sargent Cypress and an area of McNab Cypress. In the immediate area occur numerous individuals, which in all their features indicate a hybrid origin from the above parents." For my opinions about this, consult the discussion under the Red Mountain locality for both *C. Sargentii* and *C. Macnabiana*. 17). Elwes & Henry, Trees of Great Brit. & Irel. 5: 1174. 1910. *C. nivalis* Lindl. in Gard. Chron. 1855, p. 421, and *C. glandulosa* Hook. ex Gord. Pinet. are listed as synonyms. Henry regards *C. Bakeri* Jepson as a

variety of *C. Macnabiana*, although apparently he has seen no specimens. According to this account, *C. Macnabiana* was first found by Jeffrey in 1853 because the following notes were on his (Jeffrey's) plant: "*Juniperus* no. 1481, Sierra Nevada Mountains growing in barren sandy places. Tree 15 ft. high, 1 ft. diam., Oct. 1st 1853." 18). Camus, *Les Cypres* 45. 1914, in part, except for the Seiad Creek reference. 19). Dalli. & Jacks., *Handb. Conif.* 207. 1923. *C. glandulosa* Hook. and *Juniperus Macnabiana* Laws. are cited as synonyms. In a note following *C. Macnabiana*, these authors insert *C. Bakeri* Jepson and state: "This tree appears to differ only from *C. Macnabiana* in its smaller, glaucous cones, with smaller less prominent umbos." 20). Abrams, *Ill. Fl. Pac. States* 1: 73. 1923, in part, as to description and distribution. *C. glandulosa* Henk. & Hochst. and *C. Bakeri* Jepson are cited as synonyms. 21). Jepson, *Man. Fl. Pl. Calif.* 58. Fig. 50, a & b. 1923. 22). Rehd., in Bailey, *Cult. Evergr.* 209. Fig. 33. 1925, in part. *C. glandulosa* Hook., *C. Bakeri* and *C. nevadensis* Abrams are listed as synonyms. 23). Sarg., *Man. Trees of No. Am.* 2nd ed. 72. 1926, in part. *C. Bakeri* Jepson and *C. nevadensis* Abrams are listed as synonyms. 24). Sudw., U.S.D.A. Misc. Circ. 92: 37. 1927, in part. 25). Rehd., *Man. Cult. Trees & Shrubs* 16. 1927, in part. 26). Wieslander, *Madroño* 1: 186. 1928. This is a distributional note commented upon elsewhere under distribution of this species. 27). Benson, *Contrib. Dudl. Herb.* 2: 33. 1930, in part. The Oregon material referred to this species is *C. Bakeri-Matthewsii*. Benson lists as synonyms *C. glandulosa* Henk. and Hochst., *Juniperus Macnabiana* Laws., *C. californica-gracilis* (Nelson) Senilis, *C. Nabiana* Mast., and *C. Bakeri* Jepson. 28). *Madroño* 2: 31. 1931. This is an open letter from C. S. Robinson regarding a specimen of cypress from Tehama Co., Calif. which he thought to be *Cupressus Macnabiana* var. *Bakeri*. Jepson's reply is that the specimen is *C. Macnabiana*, and lists four stations for *C. Macnabiana* in the Lassen National Forest. The first two are *C. Bakeri typica*; the others are *C. Macnabiana*. 29). Van Dersal, *Nat. Woody Pl. U. S.* 115. 1938, in part. Van Dersal lists *C. Bakeri* Jepson and *C. nevadensis* Abrams as synonyms. He also states that the seeds are shed immediately, but my observations are that this is not true for this species. 30). Eliot, *For. Trees Pac. Coast* 232. Fig. 100. 1938, in part. 31). McMinn, *Ill. Man. Calif. Shrubs* 41. Fig. 9. 1939, in part. The statement "Collected by Nacnab" is an error. 32). Rehd., *Man. Cult. Trees & Shrubs* ed. 2. 56. 1940.

CUPRESSUS MACNABIANA var. *SULPHUREA* Breckmans, *Catalogue of Fruitland Nurseries*, Augusta, Georgia 56. 1915-16. "A new variety; foliage glaucescent green with golden tips, an extremely beautiful conifer." 2). Rehd., *Man. Cult. Trees & Shrubs* 16. 1927. This variety is said by Rehder to have branchlets with yellow tips.

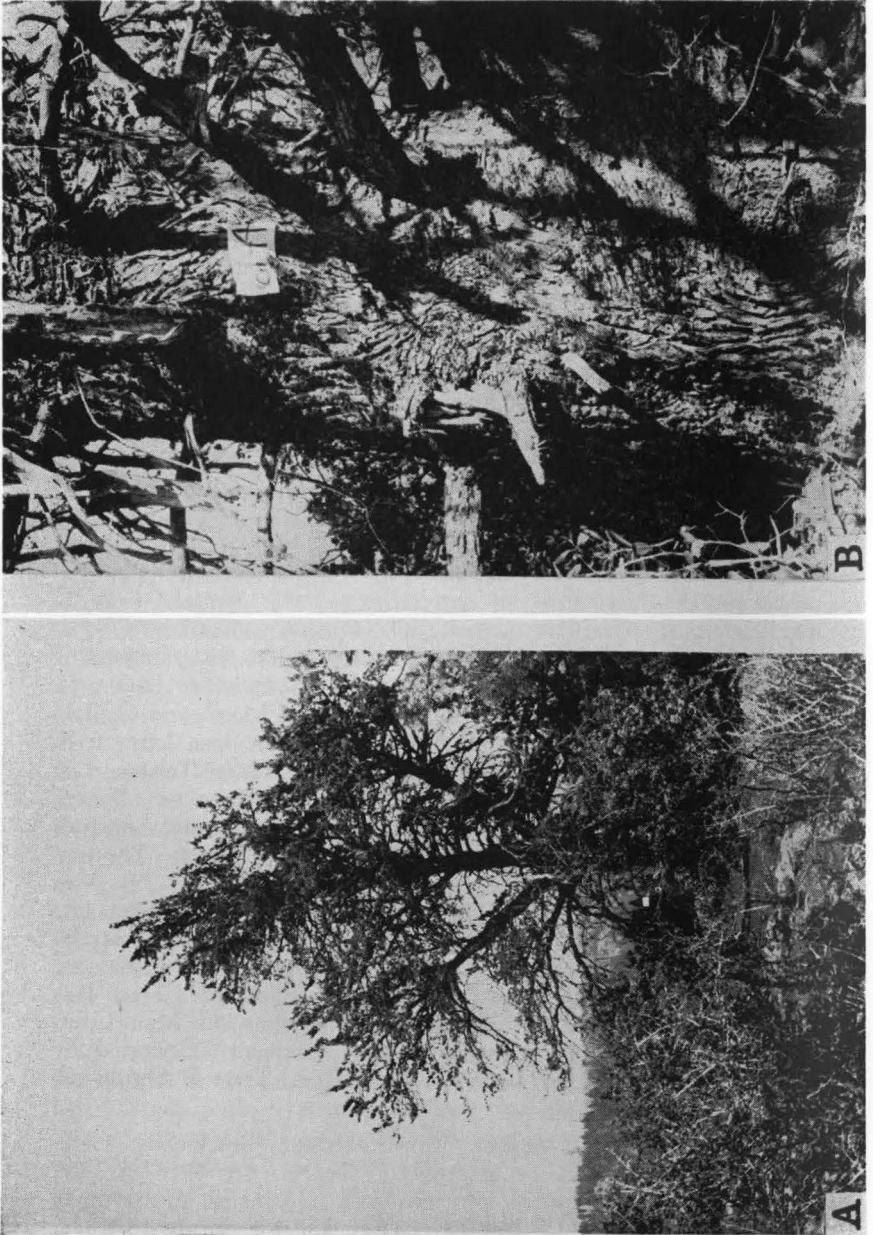


FIGURE 18. *Cupressus Macnabiana*. For explanation see opposite page.

CUPRESSUS ATTENUATA Gord. & Glend., Pinet. 57. 1858. These authors cite *C. nivea* Hort. as a synonym. *C. attenuata* is described as having "leaves with sunken gland on the back, glaucous, a slender bush 6 to 10 feet high", and was from the banks of streams in the Shasta Country and other mountain valleys in northern California. It was said to have been introduced by the French collectors. It is difficult to refer this name to any other species except *C. Macnabiana*, for the description fits that species. However, Benson (Contrib. Dudl. Herb. 2: 31. 1930) regarded it as a synonym of *Chamaecyparis Lawsoniana* (Murr.) Parl. *C. attenuata* is also referred to *Cupressus Lawsoniana* in the Index Kewensis. 2). Gord. & Glend., Pinet. ed. 2. 79. 1875. *C. Bourgeauii* Hort. is cited as a synonym. This is essentially the same concept as in the first edition, but they mention that it has been collected in the Oregon Territory by Lobb. I doubt if Lobb's specimens actually came from Oregon as known today or that he found *C. Bakeri typica* or *Matthewsii*. *C. Bourgeauii* Hort. is referred to *C. Goveniana* in the Index Kewensis.

CUPRESSUS GLANDULOSA Henk. & Hochst., Syn. Nadelh. 241. 1865.

JUNIPERUS MACNABIANA Laws., in Gord. Pinet. 64. 1858. Based on *Cupressus Macnabiana* Murr.

FIGURE 18. *CUPRESSUS MACNABIANA*—McNab Cypress. On "Red Hill" between Oleta and Aukum, Amador Co., Calif. Coll. No. 6144 (Prop. No. 2111). Photos Oct. 2. 1934. A—Habit; tree about 13 m. high. Neg. No. 3217. B—Trunk over 1 m. in diam. Neg. No. 3219.

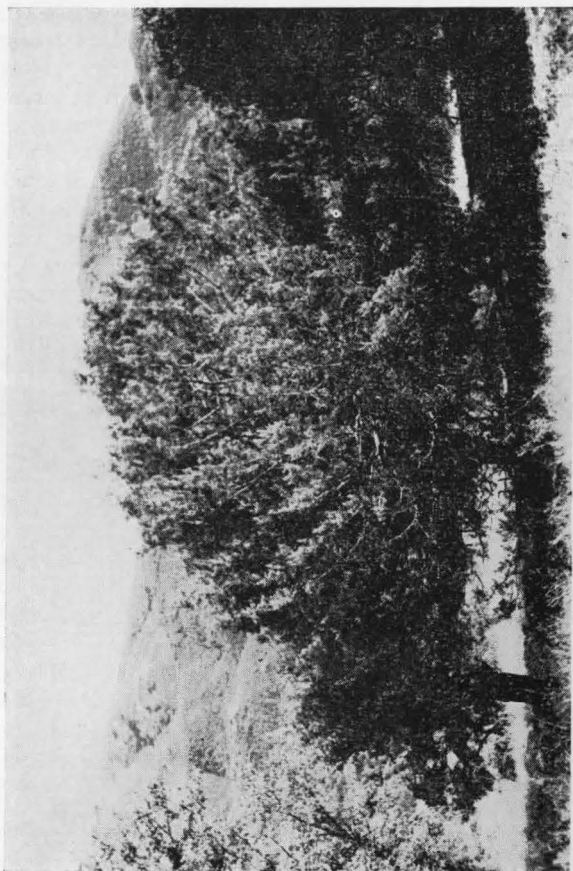


FIGURE 19. CUPRESSUS MACNABIANA—McNab Cypress.
Along Pieta Road, west of Highland Springs, Lake Co.,
Calif. Coll. No. 6186 (*Prop.*
No. 2143); about 7 m. high. Photo Oct. 14, 1934. Neg. No. 3315.

2. CUPRESSUS BAKERI—Modoc and Siskiyou Cypresses

Cupressus Bakeri Jepson, Fl. Calif. 1: 61. 1909. A slender tree 10 to 30 m. high, with a spread seldom exceeding 10 m., a typically narrow crown or at least sparse, with a central leader and a trunk whose diameter rarely exceeds 6 dm. (rarely nearly 1 m. in diam.). The bark reddish-brown or cherry-like, only partially exfoliating on the main trunk; on old trees the outer layer becomes grayish, but in no way does the bark ever become truly fibrous or shreddy, although it may build up to a thickness of about 2 cm., the irregular plates of which generally curl upward at the tips. In general aspect, the trees are gray-green, due to the color of the leaves and also to the accumulation of resin from the active glands on the dorsal surface of the leaves. Branchlets more or less evenly disposed on all sides of the branches, being either opposite or alternate, rather slender, the unbranched ones of the season varying from 5 to 20 mm. or more in length by 0.5 to 1.3 mm. thick, but becoming thicker in age or on slow growing shoots. Leaves about 2 mm. long, rather acutely pointed, the back or dorsal surface slightly ridged or rounded, the tip rather abruptly constricted, the dorsal gland conspicuous and active, visible on even the very youngest leaves. On vigorous shoots the leaves continue to enlarge and may become as much as 10 mm. long by 3 to 4 mm. wide and have a spreading acute tip larger than the original leaf and on which the gland is borne. On branches which are not shed after the second year, the dead leaves are gradually pushed off by the expanding bark disclosing the brown bark beneath. Staminate cones abundant, appearing on trees 6 or 7 years old and produced regularly thereafter at the tips of young branchlets which may vary from no visible length to as much as 20 mm.; cones 2 to 3 mm. long, nearly globose; but, before the pollen is shed, are angular because of the distinctly flattened face of each of the usually 8 (sometimes 6 to 10) peltate scales around whose margins are to be seen the pollen sacs. These scales are usually 2 to 2.5 mm. broad, the upper portion obtusely triangular, ciliate-margined, the basal half distinctly rounded. Upper and lower scales bear only 3 pollen sacs while the central ones may have 4 or 5 attached in an irregular row around the lower half of the scale. Ovulate cones scattered or fairly abundant, produced nearly throughout the tree and, at first, appearing as rather well imbricated and slightly enlarged branchlets. At the time of pollination, the numerous ovules are easily visible at the base of each scale. At the end of the first season, the cones are still green, are usually less than 10 mm. in diam., nearly globose, but have well pronounced umbos or horns, but are otherwise rather smooth. During the second season, the cones enlarge reaching a maximum length of about 23 mm., and are somewhat less in diam. The horns or umbos which were at first conspicuous become less noticeable as the

cones mature, but the surface becomes warty due to the formation of numerous pitch pockets, also the surface becomes grayish or, at least, a dull brown. The seeds vary from about 50 to 85 per cone, are 3 to 4 mm. long, usually a little narrower, are comparatively thin, although angular, are light tan, usually with numerous warty pitch pockets and a rather thin wing, often nearly 1 mm. broad. The hilum is conspicuous and much lighter tan than the seed coat. In seedlings the 3 to 4 cotyledons push the seed coat above the ground, then expand at nearly right angles to the stem and become 8 to 13 mm. long, are linear but a little flattened and have a blunt tip. The next leaves are similar but shorter, spine-tipped, in whorls of 4. These juvenile leaves are produced during the first 2 years of growth, and eventually the branches produce transitional forms bearing active glands. As the plant grows older, the mature type of leaf is formed and usually no further juvenile leaves are produced.

Range

United States. California and Oregon. Known only from four main areas: The Siskiyou Mountains of Josephine County, Oregon and of Siskiyou County, California; Goose Nest Mountain, Siskiyou County; the vicinity of Timbered Crater in southeastern Siskiyou County; and the vicinity of Burney Springs, Shasta County.

Habitat

This species is confined to the typical Arid Transition Zone varying in its associated species with *Pinus ponderosa*, *P. Lambertiana*, *P. attenuata*, *Abies concolor*, *Juniperus occidentalis*, *Pseudotsuga taxifolia* and *Arctostaphylos patula*. It is largely confined to volcanic soil (basalt) or to serpentine and occurs at elevations ranging from about 3800 ft. to nearly 6000 ft. Throughout its range it seldom forms much of a pure stand; that is, it never comprises more than a small fraction of the total woody vegetation of the areas in which it grows, despite the fact that, in most instances, the trees are restricted to what may well be termed "cypress islands".

Key to the Subspecies of *Cupressus Bakeri*

Average mature tree 10 to 15 m. high; aspect of foliage a definite gray-green; branchlets mainly less than 12 mm. long by 0.5 to 1.0 mm. thick; ovulate cones rarely much over 12 mm. in diam., definitely gray-surfaced when mature, and only slightly warty surfaced, the umbos rather conspicuous, especially those on the upper pair of scales.

2a Subspecies *typica* (p. 73)

Average mature tree 15 to 30 m. high; aspect of foliage a light gray-green; branchlets mainly over 12 mm. long and often 20 mm. long by 1.0 to 1.3 mm. thick; ovulate cones usually 15 to 20 mm. in diam., often as much as 23 mm. in diam., the surface usually light gray-brown, usually rather conspicuously warty surfaced, the umbos rather inconspicuous.

2b Subspecies *Matthewsii* (p. 83)

Discussion of the Subspecies of *Cupressus Bakeri*

The two cypresses here treated as subspecies of *Cupressus Bakeri* present a number of rather definite differences which, at first glance, appear to be much greater than the differences used to separate some of the other cypresses which in this paper are treated as species. Nevertheless, the differences between subspecies *typica* and *Matthewsii*, although rather easily seen, are not the sort of differences which I consider to be sufficiently important to warrant their separation as distinct species. Subspecies *typica* is generally a less vigorous tree, has shorter branchlets, is less glandular and has smaller cones than subspecies *Matthewsii*.

2a. *Cupressus Bakeri* subsp. *typica* — Modoc Cypress

Cupressus Bakeri subsp. *typica* C. B. Wolf, nomen novum. A slender tree 10 to 15 m. high, rarely to 20 m., and most trees less than 10 m. high, spread 4 to 10 m., the central trunk usually slender with an open crown of branches which in age spreads at nearly right angles or is even somewhat deflexed. Trunk 2 to 6 dm. in diam., the basal portion bearing a reddish or gray-surfaced partially exfoliating bark which curls off in very irregular layers, and which may become 2 cm. thick in age; bark of younger trunks is more cherry-like, reddish and thinner; on small branches the bark is usually gray or gray-brown. For some reason, the bark never seems to exfoliate completely on the main trunk as in species such as *C. Forbesii* or *C. guadalupensis*; and, as a result, the trunks are never smooth and glossy red-brown as in those species. A branch from Ccoll. No. 6166 taken low on the tree was 7 cm. in diam. and was 67 years old. In aspect, the trees are a soft light gray-green because of a thin bloom on the leaves and the pitchy exudation from the active dorsal pits; this resin is at first clear but soon turns whitish. Late in the season the trees are much grayer than immediately after rains or in the spring when the new growth is produced. The foliage is pleasantly aromatic when lightly crushed. Branchlets rather slender with usually congested branchlets, the ultimate divisions of which are mainly less than 12 mm. long by 0.5 to 1.0 mm. thick. Leaves about 2 mm. long, rather acutely pointed and with a raised ridge on the back, the point is sometimes abruptly acute; the dorsal resin pit or gland is visible on the very youngest leaves and is borne well above the middle of the leaf. On vigorous shoots the leaves elongate to lengths of 10 mm. and are 3 to 4 mm. wide, bear a strongly spreading tip on which the gland is conspicuous. In age the leaves turn brown and are shed with the branch, or on very vigorous branches they are pushed off by the expanding bark beneath. Staminate cones fairly abundant, pro-

duced on young trees of 6 or 7 years of age, borne on the tips of branchlets, some of which are less than 1 mm. long and many of which are less than 0.5 mm. thick. Staminate cones nearly globose, but the usually 8 (sometimes 10 or 12) scales flat-surfaced giving the cones an angular shape, but not as pronounced as in *C. Macnabiana*. Scales less than 2 mm. broad, bearing 3 or 4 irregularly shaped pollen sacs in an irregular semi-circle on the lower half of the scale (the lower and extreme upper scales usually have only 3 sacs, while the central scales generally have 4 sacs). Ovulate cones numerous, produced on somewhat thicker branchlets than the staminate and, when first apparent, are recognizable as slightly swollen tips, the leaves of these branchlets being somewhat more imbricated than those on the vegetative shoots. Scales 6 or 8; but, frequently when 8, the 2 basal scales are very small and sterile and usually the 2 upper are also small. At the end of the first season, the cones are generally less than 1 cm. long, the surface is smooth green, and the horns are rather prominent with those of the 2 lower scales pointing downward, the next pair often spreading or erect, and the upper ones strongly erect or even incurved. During the second season, the cones reach full size of rarely over 12 mm. in length, are nearly spherical, the horns comparatively conspicuous, the surface is a gray-brown with a slight luster or sheen, is slightly warty because of the numerous pitch pockets just beneath the surface. In age the cones become a silvery-gray and, apparently, do not remain closed for very many years. Seeds approximately 50 to a cone, 3 to 4 mm. long, irregular but tending to be compressed, light tan, sometimes slightly glaucous on the body, but not on the rather thin but proportionately broad wing; hilum rather inconspicuous or sometimes much lighter colored than the rest of the seed and then plainly visible. In germination the cotyledons carry the seed coat above the ground on their tips, and after the seed coat is pushed off, they spread at nearly right angles to the main axis; cotyledons 3 or 4, rarely over 8 mm. long, linear, a little flattened, about 0.5 mm. wide, tapered to a blunt point; next leaves are in whorls of 4, usually less than 5 mm. long (some to 7 mm.) flattened and linear, but abruptly drawn down to a spine or tip. Gradually during the first two years, the new juvenile leaves produced become shorter and more like the mature foliage, the transition being so gradual as to form a complete series, some of the last transitional forms have a spreading tip and active dorsal gland. *Cupressus Bakeri* Jepson, l.c.

Type Locality

"Lava beds of southeastern Siskiyou and southwestern Modoc Cos., between Little Hot Springs Valley and Hills Farm, it is associated with Juniper, Yellow Pine and Knob-Cone Pine (M. S. Baker)."

Jepson Fl. Calif. 1: 61. 1909. The type specimen is in the Jepson Herbarium, Berkeley, California and is labelled as follows: "Between Hills Farm (near Dana; S. E. Siskiyou Co.) and Little Hot Springs Valley. M. S. Baker Aug., 1898." The species was named in honor of Milo S. Baker, who discovered it, student of Western plants, particularly of the genus *Viola*. Mr. Baker has for many years been the teacher of botany at the Santa Rosa Junior College, Santa Rosa, California and has added greatly to the knowledge of plants of that region by his years of collecting. The above reference to this species being in Modoc County is not substantiated, although the Timbered Crater locality is very close to the Modoc County line.

Range

United States. California. Burney Springs area, Shasta County; and extreme southeastern Siskiyou County in the vicinity of Timbered Crater.

Localities

1. Burney Springs, Shasta County, California. The Burney Springs locality is the southernmost known station for *C. Bakeri* subsp. *typica*. The cypress trees in this area are not confined to a more or less solid grove as at Timbered Crater but are scattered over a rather wide area. This locality may be easily reached by going to the Hat Creek Ranger Station on California State Highway No. 89 (the highway parallels Hat Creek). From the Ranger Station a dirt road leads to Burney Springs. The first cypresses are along this road about 8 miles from the Ranger Station. Before reaching Burney Springs the road skirts a large reforestation project to the south of Burney Mountain. Scattered over this area, which is largely *Arctostaphylos patula*, are a few isolated clumps of cypress which escaped the fires of the past. Most of these are less than 5 m. high. At about 9 miles from the Hat Creek Ranger Station or about 1.5 miles from Burney Springs, a side road leads off in a southerly direction to a small Forest Service Campground known as Cypress Camp. This is the favorite spot for fishermen to start their hikes into Thousand Lake Valley and Eiler Lake to the south. A poor road continues on for a mile or so past the camp, and along it are scattered cypresses. Most of the trees range from 3 to 20 m. in height, have rather slender straight trunks and sparse crowns. The trunks are usually covered with cherry-like bark, but an occasional old tree has grayish surfaced bark which is a little furrowed, but which is cherry-like beneath. However, on such trees the main branches are generally rich reddish and fairly smooth. The associated trees are *Abies concolor*, *Pinus ponderosa* and *P. Jeffreyi*, each of which

is much more abundant than the cypresses. Measurements of two fine cypress trees in this area taken on July 25, 1941 were as follows: tree No. 1 was 14 m. high, 7 m. spread and had a trunk 6 dm. in diam.; tree No. 2 was of similar height and spread, but had a trunk 4.5 dm. in diam. at the ground and 2 dm. in diam. at 7 m. Most of the area is volcanic loam, although in nearby areas the volcanic rocks are devoid of humus and fine pines and firs grow out from the crevices. This area is typical Arid Transition Life Zone and is slightly in excess of 5000 ft. in elevation. During the winter there is considerable snow. During the summer months the air is hot and dry but probably never exceeds 95 degrees F., and there may be an occasional summer thundershower.

In this same region an additional station for cypress was reported as "west of Tamarack Peak at 6200 ft." (Madroño 2: 31. 1931). Tamarack Peak appears to be the peak a mile or so to the north of Eiler Lake, according to the United States Forest Service Map of the Lassen National Forest, 1929 edition, but this same peak is shown on the Lassen Peak Quadrangle, edition 1894, reprinted 1924, as Magee Peak. However, on the Forest Service Map mentioned above, Magee Peak is several miles to the southwest and is shown on the Lassen Sheet as Crater Peak. Regardless of these discrepancies, it appears that the cypresses extend over an area of 6 or 8 miles south and east from Burney Springs and are otherwise not known in this region.

Collections:

a). W. W. Wagener and G. A. Zentmyer, Coll. No. 9433 (Prop. No. 3204, our Burney Springs Strain), July 9, 1938, from close to Burney Springs. b). C. B. Wolf, Coll. No. 11067, July 25, 1941, from $\frac{1}{2}$ mile southwest of Cypress Campground at about 5000 ft. elevation, the specimens taken from several trees to form a series showing variation in cones and foliage.

2. Timbered Crater, Siskiyou County. The Timbered Crater grove is the original station for *Cupressus Bakeri typica* and is located in the extreme southeast corner of Siskiyou County. Timbered Crater is here used to designate the area in the lava beds where the cypresses grow, although the trees do not actually inhabit the slopes of the crater. Timbered Crater is located in extreme northeast Shasta County and is approximately on the southwest corner of Section 2, Township 38 North, Range 4 East. However, the cypress trees, as far as can be determined, are all located in Siskiyou County, the center of the grove being about 1 mile northeast of Timbered Crater, the most prominent and useful landmark in this undulating lava bed country.

When I first visited this grove of cypresses in October of 1930, I reached it by going to the C. W. Hill Farm, near Dana at

the upper end of the Fall River Valley. From near the Hill Farm an old stage road ran out across the lava beds in a northeasterly direction, past Timbered Crater and on across to Little Hot Springs Valley (a place called Day). At that time, the old road was distinct enough but was not really advisable for travel by car, so I obtained a saddle horse from Mr. Hill and rode out to the grove of cypresses which Mr. Hill had seen at times in the past, and which he assured me I could not miss if I remained on the old road, the beginning of which he pointed out to me. Shortly after passing to the northwest of Timbered Crater, I came upon the cypresses which were rather abundant and formed a considerable percentage of the tree growth in the area, if not a dominant species for a considerable distance. Most of the trees were fairly well spaced so that they were well developed more or less symmetrically, and their crowns were somewhat thicker than those of the trees in the Burney Springs area. For the most part, the trees were seldom over 13 m. in height and 6 or 7 m. in spread, usually with a trunk less than 6 dm. in diam. at the ground level. They were characteristically rather slender with a single central leader, and the somewhat exfoliating bark was generally a rich deep red, or the old surface layers grayish. However, on old trunks the bark did not peel off leaving a clean red surface beneath. The soil in this area is lava rock, mainly a deep brown or grayish-brown in color, and there is very little humus or even fine decomposed lava. Despite this the lava beds support a remarkably thrifty looking forest of *Pinus ponderosa*, *P. attenuata*, *Juniperus occidentalis* and *Libocedrus decurrens*. *Arctostaphylos patula* and a form of *Ceanothus integerrimus* are the most common shrubs, but others almost equally abundant are: *Artemisia tridentata*, *Cercocarpus ledifolius* and *Purshia glandulosa*. The entire area on which the cypresses grow is approximately 4000 ft. in elevation and is rather level but of an undulating nature with huge pits and rock piles so that it is difficult to see in any direction for any great distance.

In 1934 I returned to this area to re-collect seeds and specimens and found that shortly before that time the Civilian Conservation Corps, under the direction of the United States Forest Service, had built a new road across the lava beds. This new road roughly parallels the old stage road mentioned above but is north and west of it in the area where the cypresses grow, so that if one drives across from Dana to Day on the new road no cypresses will be seen. When driving in from Fall River, follow the new road for 5 5/10 miles at which point the original road swings off at a slight angle to the east but is roughly parallel to the new road for a short distance. It would be possible to drive out to the cypresses on this old road, but the distance is not more than 2 miles, and it is not only easier to walk in, but probably about as quick. In this area there is little evidence of recent fires, and many old mature and dead trees are

standing. Young seedlings are abundant, and the larger trees are rather heavily laden with cones. In no way does the appearance of this grove suggest that the subspecies is dying out. The mature cones are silvery-gray and a little warty because of the sub-surface pitch pockets. The extent of this grove is about a mile or so along the old road and extends only a short distance west. Possibly, it has a greater range to the east, but it is doubtful if any trees extend over into Modoc County, the boundary of which is at least two miles to the east of the road.

On October 30, 1944, I was again able to spend part of a day in the Timbered Crater Grove of cypresses. Despite a continuous rain during the several hours that I was there, I hiked over practically the entire cypress area. I was again unable to detect any changes in soil, elevation or any other visible ecological factor which would account for the abruptness with which the cypress trees stop at the edges of their little "island". I particularly noted that most of the trees of 10 m. or over in height appeared to be dead at the top and might well be considered as over-mature. Within the area there were many clumps of fine young trees 2, 3, or 4 m. high. Almost without exception, however, these were within the limits of an imaginary boundary line drawn to encompass all of the mature cypress trees of the area. It would thus appear that within this island the species stands a reasonable chance of perpetuating itself, but that it is, at present, unable to extend its limits. At that time (October 30, 1944), I noted that some of the cypress trees were well laden with staminate cones, many of which were already shedding their pollen.

Collections:

a). Milo S. Baker, Aug., 1898 (Type—Jepson Herb.); b). W. L. Jepson 5764, Aug. 11, 1914 (Jepson Herb., Calif. Acad., R.S.A.); c). C. B. Wolf, Coll. No. 1746 (Prop. No. 1006), October 19, 1930, from a tree 10 m. high, 4 m. spread, and a trunk 2 dm. in diam.; d). C. B. Wolf and E. R. Johnson, Coll. No. 6166 (Prop. No. 2127, our Timbered Crater No. 1 Strain), October 8, 1934, from a tree 13 to 14 m. high, 10 m. spread, and a trunk 5 dm. in diam. at the ground, then divided at 1.3 m. into 2 trunks 3 and 4 dm. in diam. each; e). C. B. Wolf and E. R. Johnson, Coll. No. 6167 (Prop. No. 2128, our Timbered Crater No. 2 Strain), October 8, 1934, from a tree 10 to 11 m. high, 6 to 7 m. spread and a trunk 3.5 dm. in diam. at 1.5 m. and 1.2 dm. at 7 m.; f). O. V. Matthews, No. 40, July 22, 1939; g). O. V. Matthews, No. 41, July 22, 1939; h). O. V. Matthews, No. 42, July 22, 1939, from a tree nearly 13 m. high and, according to Mr. Matthews, is the tallest tree in this grove; i). C. B. Wolf, Coll. No. 11481 (Prop. No. 5053), October 30, 1944. This collection consists of a rather large series of sheets of material, each of which comes from a different

tree in order to obtain a representation of the range of cone size and other variations. In addition, there is a piece of bark (No. 1) from the main trunk of a tree 8 m. high and 2.5 dm. diam.; a second piece of bark (No. 2) was taken from a tree 10 m. high and 4.5 dm. diam. A wood sample was cut from a tree 4 m. high at a point 6 dm. above ground; with a diam. of approximately 8 cm. and with about 65 to 70 annual rings.

The principal differences between the Burney Springs and the Timbered Crater Grove are that the former occurs fully a thousand feet higher in elevation, and has, perhaps, a few more large trees (up to 20 m.). The latter forms more of a grove and produces cones more abundantly (perhaps, only because the trees are less shaded). The individual branchlets of the Timbered Crater Strain are slightly less in diam. and more congested than those of the Burney Springs specimens, but this may be due, in part, to the slightly more arid conditions of the former area. In some features the trees in the Burney Springs Grove are thus somewhat intermediate with those of subsp. *Matthewsii*.

Collections of Cultivated Specimens

a). P. C. Everett, Coll. No. 7785, May 19, 1936, seedlings of *Prop.* No. 2127 from 4 in. pots in Garden nursery, seed flat planted March 28, 1935; 8 and 12 cm. high, with juvenile spreading leaves; root system fair. b). P. C. Everett, Coll. No. 7786, May 19, 1936, seedlings of *Prop.* No. 2128 from 4 in. pots in Garden nursery, seed flat planted March 28, 1935; 10 and 13 cm. high, with juvenile spreading leaves; roots rather long but few. c). C. B. Wolf, Coll. No. 11286, July 15, 1942, from a cultivated plant of *Prop.* No. 3204, planted in the Botanic Garden; 6 dm. high and about 3 years from seed. This specimen illustrates the transitional types of leaves produced on seedlings; for at the time it was collected there were all stages from juvenile to mature forms of leaves present. None of the strictly juvenile leaves bears dorsal glands, but on many of the intermediate forms they are clearly visible and active, although usually more elongated than on the mature leaves.

References

CUPRESSUS BAKERI, Jepson, Fl. Calif. 1: 61. 1909. Original description, for discussion see Type Locality in text. 2). Jepson, Silva Calif. 160. 1910. 3). Camus, Les Cypres 47. 1914. 4). Dalli. & Jacks., Handb. Conif. 207. 1923. These authors list *C. Bakeri* in a note following *C. Macnabiana* and state that it appears to differ from *C. Macnabiana* only in its smaller, glaucous cones, with smaller less prominent umbos. 5). C. B. Wolf, Proc. Fifth West.

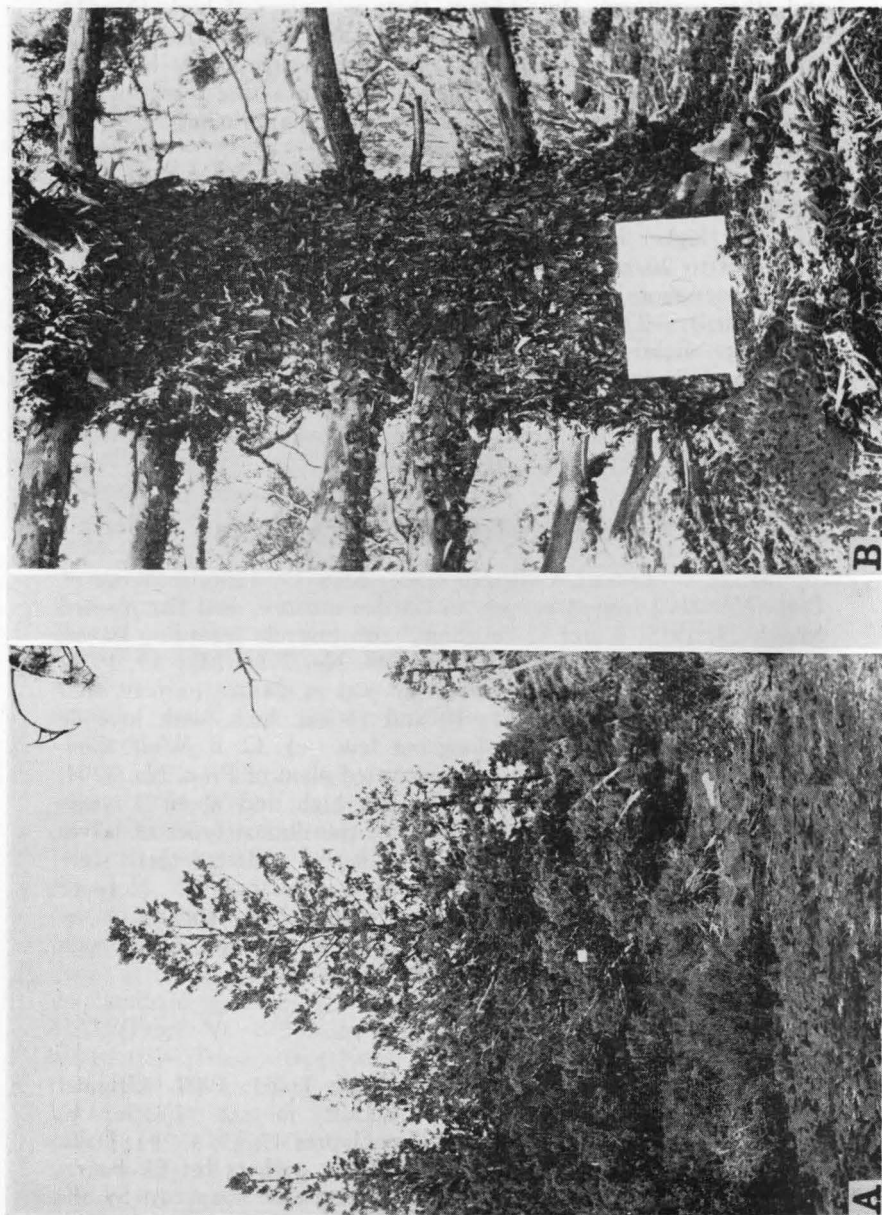


FIGURE 20. *Cupressus Bakeri* subsp. typica.

Shade Tree Conf. 39. 1938, in part, as to the southeastern Siskiyou Co. locality.

CUPRESSUS MACNABIANA, Sudw., For. Trees Pac. Slope 165. 1908, in part, as to the Burney Creek, Shasta Co. locality. 2). Elwes & Henry, Trees of Great Brit. & Irel. 5: 1174. 1910, in part. Henry suggests that *C. Bakeri* Jepson is a variety of *C. Macnabiana*, although it is evident that he has seen no specimens. 3). Abrams, Ill. Fl. Pac. States 1: 73. 1923, in part, as to the Modoc Co. reference. *C. Bakeri* Jepson is reduced to synonymy. 4). Rehd., in Bailey, Cult. Evergr. 209. 1925. *C. Bakeri* Jepson is placed in synonymy. 5). Sarg., Trees of No. Am. 2nd ed. 72. 1926, in part, as to the plants from the lava beds of Siskiyou Co., Calif. *C. Bakeri* Jepson is reduced to synonymy. 6). Sudw., U.S.D.A. Misc. Circ. 92: 37. 1927, in part. In this list, Sudworth places *C. Bakeri* Jepson in synonymy. 7). Jepson, Madroño 2: 31. 1930, in part, as to the Burney Spring and Tamarack Peak localities. 8). Van Dersal, Nat. Woody Pl. U.S. 115. 1938, in part. *C. Bakeri* Jepson is listed as a synonym only. 9). McMinn, Ill. Man. Calif. Shrubs 41. 1939, in part, as to the description and distribution, although this probably also refers to subspecies *Matthewsii*.

CUPRESSUS MACNABIANA var. BAKERI Jepson, Man. Fl. Pl. Calif. 58. Fig. 50c. 1923. Jepson's reasons for reducing his species to varietal rank are not apparent. He now calls this "Baker Cypress".

FIGURE 20.

CUPRESSUS BAKERI subsp. TYPICA—Modoc Cypress.
In lava beds east of Timbered Crater, southeastern Siskiyou Co., Calif. Coll. No. 6167 (*Prop. No. 2128*); about 10-11 m. high. A—Habit of tree. Photo Oct. 8, 1934. Neg. No. 3257.

B—Trunk of tree, showing semi-exfoliating, non-fibrous bark on main trunk and smooth branches. The white card is 10 x 15 cm. Photo Oct. 8, 1934. Neg. No. 3259.

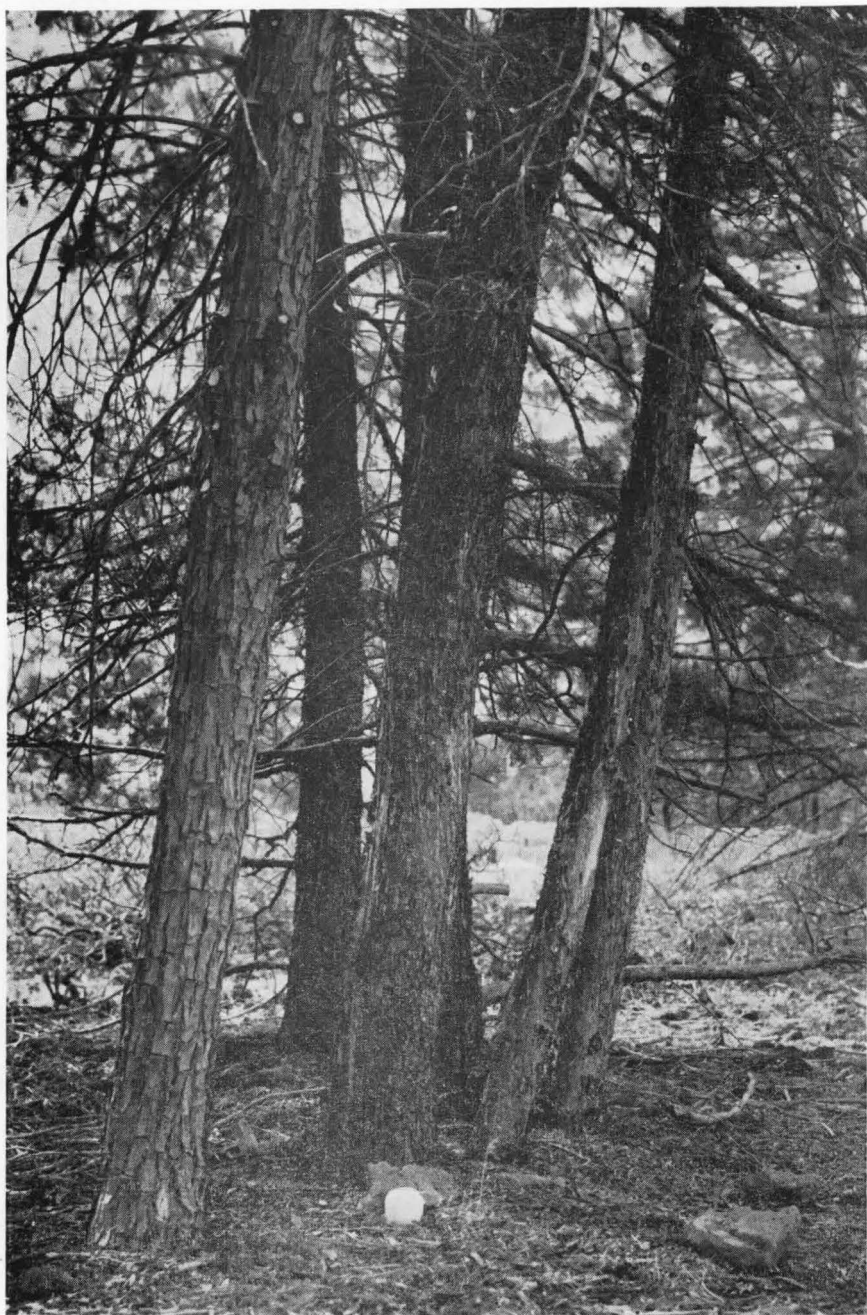


FIGURE 21. *Cupressus Bakeri*.

2b. *Cupressus Bakeri* subsp. *Matthewsii* — Siskiyou Cypress

Cupressus Bakeri MATTHEWSII C. B. Wolf, subsp. nova. A slender tree attaining a maximum height of 30 m., and with a spread of usually less than 10 m.; most trees, however, are smaller than these dimensions. The straight central trunk attains a maximum size of about 9 dm., but the usual maximum is about 6 dm., and most trees are even less than this. Bark cherry-like partially exfoliating, but in age remaining on the trunk for many years, and its surface becoming grayish-brown, but the numerous layers tending to curl up at their tips, thus presenting a very rough appearance. Bark on younger branches exfoliates more cleanly and leaves the surface a fine reddish color, but this is not smooth and polished. In general aspect, the trees are slightly less gray-green than subsp. *typica*. Growth extremely vigorous, especially of the ultimate branchlets which are often 20 mm. or over in length and 1.0 to 1.3 mm. in diam., at first rounded but soon becoming visibly 4-sided. Leaves about 2 mm. long, rather acutely pointed, the point rather abruptly produced, the back ridged or rounded and the gland conspicuous and active. On vigorous shoots the leaves become as much as 10 mm. long, by 3 to 4 mm. wide and have a spreading acute tip bearing a minute soft prickle. Staminate cones abundant, produced on tips of branches which may be over 20 mm. long or so short that the cone appears sessile on the side of another branchlet. Staminate cones 2 to 3 mm. high, 2 to 2.5 mm. thick, somewhat globose, but the 8 or 10 scales flat-faced thus giving the cone an angular appearance. The largest scales are 2 to 2.5 mm. broad, those near the base and summit bear only 3 pollen sacs, while those at the center bear 4 or 5 pollen sacs. Ovulate cones scattered or fairly abundant, but not profuse and seldom as abundant as on trees of subsp. *typica*. Scales 6 or 8, but those with 8 scales much more common. At the end of the first season, the cones are about 1 cm. long with rather conspicuous umbos, are still greenish but soon turn brown; during the second season become a lustrous gray, the surface being rather conspicuously and irregularly warty because of the numerous sub-surface pitch pockets. At maturity the cones may be as much as 23 mm. long, slightly less in diam., and generally only the horns on the upper pair of scales are still conspicuous; these may be as much as 3 or 4 mm. high, but in age weather away. Seeds 85 in an 8-scale cone from Seiad Creek, but less in cones with 6 scales. Seeds medium brown, average about 4 mm. long, but some 3 or 5 mm. long, usually a

FIGURE 21.

CUPRESSUS BAKERI subsp. TYPICA—Modoc Cypress.
In lava beds east of Timbered Crater, southeastern Siskiyou Co., Calif. Clump of small trees with trunks mostly less than 2 dm. in diam. Tree on left is *Libocedrus decurrens* Torr. Photo March 8, 1939 by Oliver V. Matthews.

little narrower than long, mostly rather flat and not as thick or angular as in many species, the wing rather thin and membranous, nearly 1 mm. broad, the hilum conspicuous and a very light tan, surface of body of seed only sparingly warty with a few minute pitch pockets. In germination the 3 or 4 cotyledons carry the seed coat above the ground, and when maximum size are about 13 mm. long, flattened slightly, linear but with a blunt tip. The next leaves are in whorls of 4 and are slightly shorter, narrower, and with a minute spiny tip. Later leaves becoming shorter, and in the second or third year the branches produce transition leaves and follow with the mature type.

Arbor gracilis ad 10 m. alta, colore quam subsp. *typica* minus glauca. Foliis ca. 2 mm. longis, interdum ad 10 mm. Amentis staminatis 2-3 mm. longis, 2-2.5 mm. crassis. Strobilis ovulatis quam in subsp. *typica* minus copiosis, squamis 6-8, pro more 8.*

Type Locality

Ridge between the West and East Forks of Seiad Creek, Siskiyou County, California, approximately three-fourths of a mile above the forks on a south slope hillside in red rocky soil at an elevation of about 3800 ft., in the Arid Transition Life Zone, in association with *Pinus ponderosa*, *P. attenuata* and *Pseudotsuga taxifolia*. The type specimen is C. B. Wolf and E. R. Johnson, Coll. No. 6169 (*Prop. No. 2130*, our Seiad Creek No. 1 Strain), October 9, 1934, from a tree about 16 m. high, nearly 7 m. in spread and with a trunk 4.5 dm. in diam. The type specimen is deposited in Rancho Santa Ana Botanic Garden Herbarium, Sheet No. 17604 and is supplemented by a wood sample, cone sample, seed sample and photographic negatives Nos. 3266 to 3269. Isotypes widely distributed.

This subspecies is named in honor of Mr. Oliver V. Matthews of Salem, Oregon, who for a number of years has been very much interested in the trees of southern Oregon, and who has made a special study of the various localities of this subspecies as well as subspecies *typica*. Mr. Matthews has not only supplied us with an excellent series of notes and specimens of these cypresses, but has taken many fine photographs which have added materially to our understanding of this species. He also contributed a number of fine photographs for the plates in Eliot's Forest Trees of the Pacific Coast (1938).

Range

United States. California and Oregon in the Siskiyou Mountains, where it is confined to the drainage system of the Applegate

*Latin description by Dr. Leon Croizat, Arnold Arboretum, Harvard University.

River, draining north and to Seiad Creek, draining south, and to Goose Nest Mountain in Siskiyou County, California. The Siskiyou Mountain localities are all confined to an area not much in excess of 20 miles north and south and somewhat less east and west. Of these the southernmost and only one south of the main divide of the Siskiyou Mountains is on Seiad Creek. This latter locality is approximately 40 miles to the northwest of the Goose Nest Mountain locality (which is less than 20 miles almost due north of Mount Shasta).

All of these areas lie within the Arid Transition Life Zone, characterized by *Pinus ponderosa*, *P. attenuata*, *Libocedrus decurrens* and *Abies concolor*, but they are comparatively high within this zone rather than at its lower altitudinal limits. In the Siskiyou Mountains snow often blankets the ground during the winter and temperature drops to zero degrees F. or even below on occasion. In this same region of the Siskiyou Mountains, but a short distance to the east in the vicinity of Dry Lake Lookout, I found that in December, 1940 the ground above 4000 ft. remained continuously frozen despite the fact that in mid-day the air temperatures rose to nearly 40 degrees F. It is probable, therefore, that the Siskiyou Mountain localities for this cypress have much the same conditions, and that the trees stand in frozen ground for several months each winter. On this basis, it is probable that no other cypress native to North America grows under such cold winter conditions as *C. Bakeri Matthewsii*, unless it be *C. arizonica* and *C. glabra* in some of their Arizona stations. However, the summer months in the Siskiyou and on Goose Nest Mountain are hot and dry, and some of the trees on the south slopes may be subjected to temperatures of over 90 degrees F.

The several groves or stations for *C. Bakeri Matthewsii* in the Siskiyou Mountains are in reality rather close together, and it may well be that careful exploration of the intervening areas would disclose that they are inter-connected by trees scattered over much of the area.

Localities

1. Miller Lake grove, Siskiyou Mountains, Josephine County, Oregon. This station for subsp. *Matthewsii* is located in the Steve Peak region on the northeast slope of Miller Peak, about one-half mile east of Miller Lake, Range 5 West, Township 40 South, approximately Section 28, Willamette Meridian. A small area one-third of a mile by about 600 ft. on a northeast exposure at an elevation of between 5000 and 6000 ft. is the extent of this grove. The trees are growing in association with *Abies concolor*, *Pseudotsuga taxifolia* and *Quercus Sadleriana*. The soil is rocky, said to be quartz mica schist.

Collections:

a). O. V. Matthews, No. 1, June 2, 1939, from a tree estimated to be about 33 m. high and a diam. of nearly 1 m. at 1 m. off ground; b). O. V. Matthews, No. 2, June 2, 1939, from a tree about 16 m. high and a trunk 4 dm. in diam. Mr. Matthew's photograph of this latter tree shows a very slender crown with a straight central leader and an open growth of branches; c). O. V. Matthews, without number, collected September, 1937.

2. Iron Mountain grove, Siskiyou Mountains, Josephine County, Oregon. This station is northeast of Steve Peak and is Range 5 West, Township 40 South, approximately Section 23, Willamette Meridian. According to Mr. Matthews, there are only about 10 good-sized trees in this locality, growing on a steep northwest exposure in serpentine, at an elevation of 4000 to 4500 ft.

Collections:

a). O. V. Matthews, No. 14, June 26, 1939, from a tree estimated to be from 17 to 25 m. high and with a trunk 7 dm. in diam.; b). O. V. Matthews, No. 16, June 27, 1939, taken from a recent windfall whose original height was about 17 m. The trees at this station are just below a typical *Pinus jeffreyi* forest.

3. Steve Peak, Josephine County, Oregon. This was reported by G. T. Benson, (Contrib. Dudl. Herb. 2: 33. 1930) as *Cupressus Macnabiana* Murr., based on a specimen by Gorman, No. 4164, which I have not seen.

4. Sterr Peak, Josephine County, Oregon. This was reported by Martin W. Gorman (Madroño 1: 275, 1919) as follows: "In August, 1917, I found *Cupressus Macnabiana* well established on Sterr Peak, 5809 ft., and on one or two adjacent peaks in Josephine County, Oregon."

5. Sullivan Mine grove, Siskiyou Mountains, Siskiyou County, California. The Sullivan Mine station is located about 3 miles south of the Blue Ledge Mine and, according to Mr. Matthews, is Range 11 West, Township 48 North, approximately Section 4. This station is only 3 or 4 miles airline northeast of the Seiad Creek grove and is, in reality, probably only an extension of it and contains only 8 or 10 trees.

a). O. V. Matthews, No. 19, July 3, 1939, from a tree 8 m. high and a trunk about 6 dm. in diam.; b). O. V. Matthews, No. 21, July 3, 1939, from a tree 25 m. high and a trunk 4 dm. in diam.

6. Seiad Creek grove, Siskiyou Mountains, Siskiyou County, California. The Seiad Creek grove (type station) lies on the ridge between the East and West Forks of Seiad Creek, and is mainly about 2 miles north and south by 1 mile east and west

in extent, and is essentially confined to Sections 7, 17 and 20, Range 11 West, Township 47 North, Mt. Diablo Meridian, and ranges in altitude from 3500 to 4500 ft., in a rocky red soil. The forested slopes are rather open, and there is considerable growth of *Pinus attenuata*, but throughout the area the ground surface is not hidden by the tree growth when viewed from the higher slopes of adjacent hillsides. This grove is easily reached by leaving Seiad Valley on the Klamath River and following a road up Seiad Creek for about 8 miles to its end which is approximately at the Forks of Seiad Creek. A trail up the West Fork of Seiad Creek begins at this point, and in less than a mile the cypress trees are reached, or they may be reached by walking directly up the ridge between the two forks of the creek, but which is more difficult.

Collections:

a). C. B. Wolf and E. R. Johnson, Coll. No. 6169 (Prop. No. 2130, our Seiad Creek No. 1 Strain), October 9, 1934, from a tree about 16 m. high, nearly 7 m. in spread and with a trunk 4.5 dm. in diam. (type collection); b). C. B. Wolf and E. R. Johnson, Coll. No. 6170 (Prop. No. 2131, our Seiad Creek No. 2 Strain), October 9, 1934, from a tree 13 to 14 m. high, 10 m. spread and a trunk a little over 3 dm. in diam., with a light cherry bark; c). O. V. Matthews, No. 30, July 11, 1939, from approximately the highest point in the grove, and from a tree about 25 m. high and with a trunk 6 dm. in diam. According to Mr. Matthews, this was the largest tree he could find in the grove. It also bore very large cones; d). O. V. Matthews, No. 31, July 11, 1939, from a tree about 16 or 17 m. high; e). O. V. Matthews, No. 32, July 11, 1939, from near the junction of the East and West Forks of Seiad Creek, from a tree about 17 m. high and a trunk 4 dm. in diam.

7. Goose Nest Mountain groves, Siskiyou County, California. As far as is now known, the stands of cypresses on this mountain are well isolated from all others, being about 40 miles southeast of the Seiad Creek grove and approximately the same distance northwest of the Timbered Crater grove of *C. Bakeri typica*. It was not until October 29, 1944 that I was able to visit the stands of cypresses on Goose Nest Mountain, and because only one day could be spared for exploring the area, I am glad to be able to draw extensively upon the information obtained by Mr. Matthews, who spent several days on Goose Nest Mountain in July, 1939, and who made extensive field notes, specimens and photographs.

The stands of cypresses on Goose Nest Mountain are rather readily accessible by driving east from Montague on the road to Mt. Hebron. This road skirts the north side of Goose Nest Mountain, and approximately 15 miles east of Montague passes the re-

mains of an old sawmill (Smith's Sawmill). Numerous old logging roads lead off to the south in that vicinity, but none of them is passable very far up the mountain. For this reason, it is better to walk from the old sawmill. By going due south about 1 mile and up the northwest slope of Goose Nest Mountain, a belt or zone of cypresses is encountered at an elevation of approximately 5500 ft. Over much of this portion of the mountain the surface is composed of huge lava rocks covered with an open forest of Yellow Pines, Sugar Pines, Incense Cedars and firs. The cypresses are scattered and form only a small proportion of the total vegetation. Occasional thickets of 50 to 100 small trees 3 to 4 m. high are common, but larger trees of 10 to 12 m. high are mostly solitary. Mr. Matthews has recorded trees at least 27 m. in height, but I did not walk over sufficient of the northwest slope to find them. Most of the trees which I observed had decidedly glandular foliage, many were shedding pollen and were thus yellowish as well as grayish in general appearance. The bark of the branches was red-brown and smooth; that of the old trunks reddish with papery-thin bark.

The northeast section of Goose Nest Mountain also has cypresses which can be reached by driving east for about 5 miles past the old sawmill mentioned above (or to approximately 20 miles east of Montague). At this point there is a Forest Service truck trail marked "Goose Nest Road No. 1". This road does not appear to be regularly maintained and so should not be attempted by car. By walking south for about 1 mile along this road, the cypresses are reached. In this area the cypresses are rather common with many specimens over 12 m. in height, as well as many vigorous small trees. The soil is mainly a sandy volcanic formation and appears to be more fertile than that of the northwest portion of the mountain. In addition to the trees mentioned for the other area, there are numerous Green Manzanitas (*Arctostaphylos patula*). It is possible that a careful search of the several miles of mountain side which separates the northwest and northeast groves of cypresses would reveal the presence of cypresses in the intervening area. According to Mr. Matthews, the cypresses reach their upper altitudinal limits just below the belt of Shasta Firs (*Abies shastensis*).

Probably, the total number of cypresses on Goose Nest Mountain does not exceed a few thousand, including the young seedlings, the stands do not appear to be on the decline, and the individual trees look remarkably healthy and vigorous.

Collections:

a). G. D. Butler, July 4, 1910 (Pom.) without definite locality. From the northwest grove: b). O. V. Matthews, No. 33, July

13, 1939, from a tree approximately 27 m. tall and a trunk about 9 dm. in diam., and said by Matthews to be the largest cypress in the northwest grove; c). O. V. Matthews, No. 34, July 13, 1939, from a tree 17 m. high and a trunk 7 dm. in diam.; d). C. B. Wolf, Coll. No. 11478 (Prop. No. 5051), October 29, 1944, from a tree 11 m. high, 7 m. in spread and a trunk 4.5 dm. in diam.

From the northeast grove: a). O. V. Matthews, No. 36, July 18, 1939, from a tree 17 to 25 m. high; b). O. V. Matthews, No. 37, July 18, 1939, from a tree 17 to 25 m. high; c). O. V. Matthews, No. 38, July 18, 1939; d). O. V. Matthews, No. 39, July 18, 1939, from a tree estimated to be from 26 to 30 m. high and possibly the tallest cypress tree on the mountain; e). C. B. Wolf, Coll. No. 11479, October 29, 1944, the fruiting material and bark specimen taken from a tree about 11 m. high, 7 m. in spread and a trunk 3.5 dm. in diam. A wood sample cut from the trunk of a tree 7 m. high at 6 dm. above the ground was a little over 1 dm. in diam. and was approximately 58 years old.

Collections of Cultivated Specimens

a). P. C. Everett, Coll. No. 7787, May 19, 1936; seedlings of Prop. No. 2130 from 4 in. pots in Garden nursery, seed flats planted March and May, 1935; 7-9 cm. high, with juvenile spreading leaves; root system well developed. b). P. C. Everett, Coll. No. 7788, May 19, 1936, seedlings of Prop. No. 2131 from 4 in. pots in Garden nursery, seed flat planted March 28, 1935; 17 and 22 cm high, with juvenile spreading leaves; root system well developed.

Relationships

When Prof. Jepson described *Cupressus Bakeri* as new in 1909, he clearly and adequately elucidated its essential characters. However, the remote regions in which the species grew, as well as a lack of understanding of certain other cypresses, prevented it from becoming well known, and the species was referred to *Cupressus Macnabiana* by numerous authors, probably none of whom ever saw *C. Bakeri* growing or made careful comparisons with *C. Macnabiana*. Even herbarium materials of these two species are readily separated on the basis of foliage alone. In *C. Bakeri* the branchlets are more or less evenly disposed around the branches (that is are juniper-like), whereas, in *C. Macnabiana* the branchlets are mainly in one plane or in small flat sprays (that is thuja-like).

Cupressus Bakeri appears to be most closely related to *C. nevadensis*, and the two are probably derived from a common stock but have been geographically isolated for so long that they have developed numerous well-marked morphological features, as well as

now occupy different life zones. Both are gray-foliaged and have active dorsal glands on the leaves. *C. Bakeri* is typically a slender tree with a sparse crown, a reddish bark that partially exfoliates and is not fibrous, slender branchlets, globose cones 10 to 20 mm. long, the surfaces of which are distinctly warty and seeds mainly 3 to 4 mm. long. *C. nevadensis* is a broadly pyramidal tree with a dense crown, a gray fibrous non-exfoliating bark (occasionally a little reddish, especially on the main branches), thick branchlets, elongated cones 20 to 30 mm. long, the surfaces of which are not conspicuously warty and seeds mainly over 4 mm. long. Perhaps, it would be better to regard *C. Bakeri* as the most distinctive development from the common stock which has produced *C. arizonica* and the species regarded as closely related to it.

References

CUPRESSUS BAKERI, C. B. Wolf, Proc. Fifth West. Shade Tree Conf. 39. 1938, in part, as to the Seiad Creek and Oregon localities. 2). Rehd., Man. Cult. Trees & Shrubs 2nd ed. 56. 1940. Rehder's treatment apparently does not include subspecies *typica*, since he refers this species only to Oregon. 3). Peck, Man. Higher Pl. Oregon 64. 1941, in part, at least as to the Oregon distribution.

CUPRESSUS MACNABIANA, Sudw., For. Trees Pac. Slope 165. 1908, in part, as to the localities listed for Siskiyou Co., Calif. 2). Jepson, Silva Calif. 160. 1910, in part, as to the Seiad Creek locality. 3). Camus, Les Cyprès 45. 1914, in part, as to the Seiad Creek locality. This illustrates the difficulty of dealing with this genus from a distance, for although Camus recognized *C. Bakeri* as distinct from *C. Macnabiana*, she failed to place properly the Seiad Creek material. Perhaps, she relied on literature. 4). Gorman, Madroño 1: 275. 1919 as to Gorman's report of cypress on Sterr Peak in Josephine Co., Oregon. 5). Rehd., in Bailey, Cult. Evergr. 209. 1925, in part, as to reference to distribution in southern Oregon, and probably as to plant referred to as hardy in the Arnold Arboretum. 6). Sarg., Trees of No. Am. 2nd ed. 72. 1926, in part, as to description and distribution of the Oregon trees. 7). Sudw., U.S.D.A. Misc. Circ. 92: 37. 1927, in part, as to the Oregon locality. 8). Benson, Contrib. Dudl. Herb. 2: 33. 1930, in part, as to the distribution in Oregon. *C. Bakeri* is reduced to synonymy. 9). Eliot, For. Trees Pac. Coast 232. 1938, in part, as to the Oregon distribution and as to Figs. 101 & 102.

FIGURE 22.

CUPRESSUS BAKERI subsp. MATTHEWSII—Siskiyou Cypress.
Seiad Creek, Siskiyou Co., Calif. Coll. No. 6169 (Prov. No. 2130).
A—Type tree, about 16 m. high. Photo Oct. 9, 1934. Neg. No. 3267.
B—Bark of type tree, white card on trunk is 10 x 15 cm. Photo Oct. 9, 1934. Neg. No. 3268.

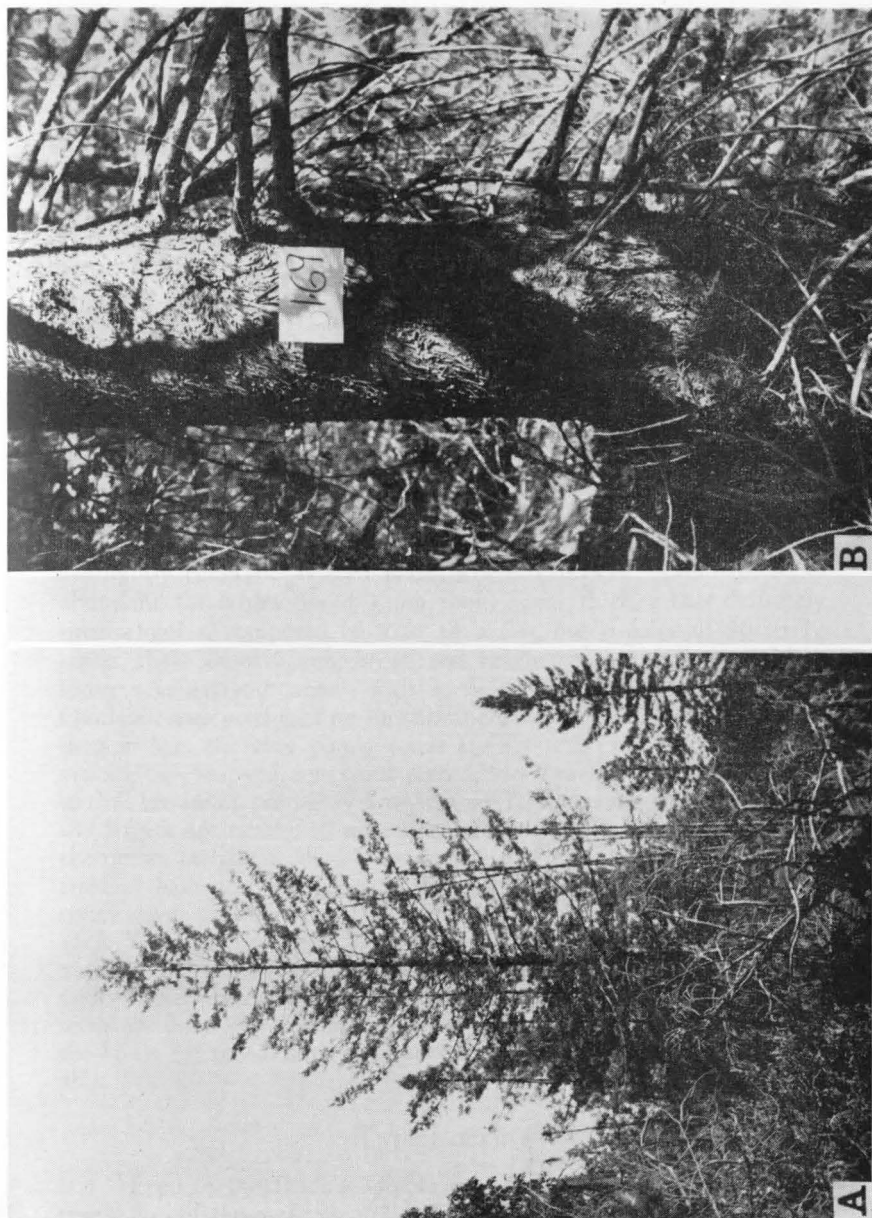


FIGURE 22. *Cupressus Bakeri* subsp. *Matthewsii*.

3. CUPRESSUS MONTANA—San Pedro Martir Cypress

Cupressus montana Wiggins, Contrib. Dudl. Herb. 1: 161. pl. 11. Fig. 1. 1933 "Tree 5-20 m. high with a trunk 2-5 dm. or infrequently up to 1 m. in diameter, clothed from the ground with numerous spreading branches, the tips slightly ascending, forming an open to rather compact pyramidal crown; bark of the trunk narrowly ridged and shreddy, persistent, deep red to chocolate-brown, that of the younger branches and twigs gray-brown, exfoliating in irregular scales to expose small patches of smooth light gray-red bark which soon become the color of the surrounding surface, not polished;"—Ex. char.

Season's branchlets sometimes unbranched for over 20 mm., but mostly 8 to 12 mm. long, rather thick, 1.5 to 2 mm. thick. Young leaves 1.5 to 2 mm. long, 1 to 1.5 mm. broad, acutely pointed and even the very youngest leaves bear active dorsal pits. On vigorous branches the leaves enlarge and may become over 5 mm. long, 3 to 4 mm. wide and have a slightly spreading tip; the margins of the leaves are lightly fimbriate as seen under a lens (10.5x). Staminate cones abundant, the largest about 3 mm. long, 2 mm. thick, rather definitely quadrangular, composed of 8 to 14 scales, but usually of 10 to 12 scales, these about 2 mm. broad and bearing 3 to 5 pollen sacs (the lower and extreme upper with 3, the central either 4 or 5 sacs). Ovulate cones produced on short branches which may become 10 mm. long in age; the very young cones are about 2 mm. long when first visible; one-year-old cones not seen; cones nearing maturity are rich to dull brown or even gray-brown, vary from nearly globose to ovoid, the largest are nearly 30 mm. long, the scales 8 to 12, but mostly 8, the umbos rather inconspicuous, only 2 to 3 mm. high, usually broadened at base and then conical, but some are crescent-shaped. The cones open immediately following maturity and shed their seeds (acc. Wiggins); contain about 60 or 70 per cone. Seeds light tan, variable in size and shape, the largest about 5 mm. long, 4 mm. wide, rather thin and with a narrow wing about 1 mm. broad, most seeds are only 3 or 4 mm. long, and are usually a little less in width; the hilum 0.5 to 1.0 mm. long, very light brown. Seedlings not available.

Type Locality

"Type in the Dudley Herbarium, No. 194170, collected at the upper end of the meadow at La Encantada, Sierra San Pedro Martir, altitude 2,300 meters, Wiggins & Demaree 4990, 22 September 1930." Wiggins, Contrib. Dudl. Herb. 1: 161. 1933. Isotype in Rancho Santa Ana Botanic Garden Herbarium, sheet no. 14,118.

Range

Mexico. Baja California. Confined to the Sierra San Pedro Martir. "From the writings of earlier collectors in Baja California it would seem that this tree is extremely rare in the Sierra San Pedro Martir. Although it is not common over the whole area, yet in certain localities it is by no means rare, some of the small canyons at an altitude of 2,200 to 2,400 meters supporting considerable stands of this cypress. Goldman collected it" . . . in a notch at about 2,700 meters altitude on the crest of the San Pedro Martir Mountains several miles east of Vallecitos. . . . "Between Vallecitos and La Encantada are several fine groves, in one of which the largest specimen seen was growing. It was nearly 25 meters high and about a meter in diameter a like distance from the ground. On the ridges east of La Encantada this cypress ascends to an altitude of about 2,825 meters." —from Wiggins, Contrib. Dudl. Herb. 1: 164. 1933.

It would appear from Wiggins' account of the distribution of *Cupressus montana*, that the species is rather widely distributed over some of the higher parts of the Sierra San Pedro Martir, and that it is the only species of cypress present in that range. The only other cypress known to occur on the mainland of Baja California is *C. Forbesii* of which there is a grove in the foothill country west of San Antonio Mesa, or approximately 70 miles south of Ensenada; it is probably on the mountains adjacent to the California boundary.

Collections:

a). Wiggins and Demaree, No. 4980, (R.S.A., Dudl. Herb.), September 21, 1930, from Vallecitos, at 7900 ft., . . . "leaves green"; b). Wiggins and Demaree, No. 4889, (R.S.A., Dudl. Herb.), September 22, 1930, from a dry hillside at the upper end of La Encantada, altitude 2300 m., "leaves glaucous"; c). Wiggins and Demaree, No. 4990, (R.S.A., Dudl. Herb.), (Type collection), from the same spot as the above No. 4989.

Relationships

The position of *Cupressus montana* was long misunderstood, and many authorities referred the material from the Sierra San Pedro Martir to *C. guadalupensis*, a strictly insular species. Although I have not seen either *C. montana* or *C. guadalupensis* growing in the wild, we do have both species under cultivation, and there is little similarity between the two. *C. montana* has much harsher and thicker branchlets with leaves bearing active dorsal pits. *C. guadalupensis* has slender branchlets and soft foliage with leaves lacking active dorsal pits. If Dr. Wiggins is correct in his statement that the cones of *C. montana* open immediately upon maturity, this is also another important difference, and a character known thus far in the

North American species only in *C. lusitanica* (at least as to the material cultivated in our plots).

C. montana and *C. Stephensonii* are somewhat alike in foliage characters, but their bark is different. The latter is a distinctly cherry-bark species in which the bark exfoliates cleanly, while in *C. montana* the bark is somewhat fibrous and does not exfoliate cleanly.

On the basis of Wiggins' statements and our observations, it seems that *C. montana* has much more in common with *C. nevadensis* and *C. arizonica* than with any of the other species. It is probable that the reference of *C. arizonica* for Baja California by Standley (Contrib. U. S. Nat. Herb. 23: 63. 1920) is based on material of *C. montana* from the Sierra San Pedro Martir. This suggests the relationship pointed out above.

References

CUPRESSUS MONTANA Wiggins, Contrib. Dudl. Herb. 1: 161. pl. 11. Fig. 1. 1933. Original description, for quotation see Type Locality in text.

CUPRESSUS ARIZONICA Standl. Contrib. U. S. Nat. Herb. 23: 63. 1920, in part, as to the reference to distribution in Baja California.

CUPRESSUS GUADALUPENSIS Lemm., West. Am. Conebearers, 3rd ed. 75. 1895, in part, as to the distribution on the "peninsula of California". 2). Lemm., Sierra Club Bull. 4: 116. 1902. in part, as to the distribution on the mainland of Baja California. 3). Goldman, Contrib. U. S. Nat. Herb. 16: 312. 1916. This reference is from the annotated list of species collected by E. W. Nelson and E. A. Goldman in Baja California in 1905-06. The record of a cypress is based on a collection "in a notch at about 2,700 meters altitude on the crest of the San Pedro Martir Mountains several miles east of Vallecitos, July 15". Goldman assumes that their collection is the same species as an earlier one from the same range by Townsend and Anthony. He also suggests that it is very unlike *C. Goventiana* and "may prove to differ from *guadalupensis*". This doubt about the identity of this cypress is evidenced by the question mark following the listing of it as *C. guadalupensis*. 4). Nelson, Mem. Nat. Acad. Sci. 16: 131. 1921. In this part of Nelson's paper on the natural resources of Baja California, he lists *Cupressus guadalupensis* (?) as one of the plants characterizing the Transition Life Zone of the San Pedro Martir Mts. It is interesting to note in the reference to cypress cited above that Nelson was unwilling to venture what species it might be, and in this second reference in the same work he questions assigning it to *C. guadalupensis*. 5). Rehd., in Bailey, Cult. Evergr. 210. 1925, in part, as to the reference to distribution in Lower California. 6). Sarg., Man. Trees No. Am. ed. 2. 73.

1926, in part, as to the reference to the San Pedro Mt. distribution. 7). Sudw., U.S.D.A. Misc. Circ. **92**: 37. 1927, in part, as to the distribution in the Sierra San Pedro Martir.

CUPRESSUS SP. Nelson, Mem. Nat. Acad. Sci. **16**: 104. 1921. "A few cypresses (*Cupressus* sp.) occur on northerly slopes at from 8,500 to 9,000 feet". This is from Nelson's discussion of the trees of the high parts of the San Pedro Martir Mts., Baja California.

4. CUPRESSUS ARIZONICA—Arizona Cypress*

Cupressus arizonica Greene, Bull. Torr. Club 9: 64. 1882. A dense to somewhat openly branched tree 10 to 23 m. high, with a spread seldom exceeding 10 m., generally with a straight central leader, the trunk of which rarely exceeds 9 dm. in diam. Bark of lower portion of main trunk variable as follows: 1). on young saplings with trunk diam. up to 1.5 dm., the bark is smooth, cherry-red, exfoliating annually in thin, curling, non-fibrous plates; 2). on trees with trunks 1.5 to 3 dm. in diam., the surface is generally dark brown or blackish and is formed into irregular squarish or oblong plates which, although thin and nearly non-fibrous, fail to exfoliate; 3). on trees with trunks over 3 dm. in diam., the bark becomes gray, dark brown or nearly black, is split with longitudinal furrows, is frequently 4 cm. thick, and is fibrous or shreddy and does not exfoliate, although on old trunks the accumulated annual layers of bark often tend to separate. The larger branches have smooth, cherry-red or mahogany-brown exfoliating bark like that of the main trunk of saplings, but occasionally on old trees the lower portions of the larger branches have bark which does not exfoliate cleanly and builds up into several rather easily separable layers. In general aspect, the trees are a dull, dusty-green, gray-green, or occasionally glaucous blue-green; most young or very thrifty trees are distinctly bluish-green and glaucous. Branchlets evenly disposed on all sides of the branches, either alternate or opposite, standing out strongly, those of the season often unbranched for 20 mm., 1 to 1.7 mm. thick (occasionally 2 mm. thick). Leaves about 2 mm. long, sharply acute, keeled or ridged on the back. In this species, the dorsal gland shows considerable variation. On some trees nearly every leaf bears an active open gland, the resin from which forms a whitish dot; on others, the glands are found on nearly every leaf, but are mainly inconspicuous, closed and inactive; on still others, a large percentage of the leaves is without visible glands, while the remainder of the leaves bear inactive or occasional active glands. Margins of leaves fimbriate as seen under a low power lens (10.5x). On vigorous branches the leaves enlarge and may become 12 mm. long, 3 to 4 mm. wide, and have an acute, spreading tip. These leaves are usually of short duration, soon turn brown and are pushed off by the expanding bark of the branch beneath. Staminate cones 2 to 5 mm. long, about 2 mm. thick, rather cylindrical, tapering to tip, the surfaces only slightly flattened (that is 4-sided), composed of 12 to 20 scales (usually 14 to 16), each scale about 1.8 mm. broad, rounded at base, triangular at apex, margins a little fimbriate, the pollen sacs 4 to 6, but the basal and terminal scales usually with only 4

*In order to distinguish this from *C. glabra*, which is widely known as Arizona Cypress, it is proposed that it be called Rough-Barked Arizona Cypress or True Arizona Cypress.

sacs. Ovulate cones produced at the ends of short, stubby branchlets which are somewhat thicker than the staminate or vegetative branchlets and have their leaves well imbricated. Prior to pollination the cones are about 3 mm. long, equally broad, and have slightly fimbriate-margined scales. Following pollination the cones turn from green to brownish, but are usually very glaucous-gray during the first season and attain a diam. of about 10 mm. Cone scales 6 to 8, these with a conspicuous conical or flattened umbo 3 to 4 mm. high, which gives the cone a rather angular appearance. During the second season, the cones lose much of their glaucous color, become dull gray to brown or sometimes purplish and have a slightly warty surface; umbos on the 4 lower scales usually are recurved, those on the upper scales are erect or incurved. At maturity the largest cones are about 25 mm. in diam., borne on a stubby branch 2 to 4 mm. long. Cones usually remain unopened for several years and frequently hang on for many years after shedding their seeds. On the other hand, occasional trees appear to shed their seeds shortly after maturity. Seeds average 90 to 120 per cone, are medium to dark brown, rarely a little glaucous, mostly rather thin and oval to orbicular, 3 to 6 mm. long, but mostly about 4 to 5 mm. long, main body either smooth or with a few warty pustules; wing of seed about 1 mm. broad; hilum a little lighter than the body of the seed, and about 1 to 2 mm. long. In germination the 3 or 4 cotyledons carry the seed coat above ground, then expand and stand at nearly right angles to the main axis. Cotyledons 10 to 12 mm. long, linear and only slightly flattened, the tip blunt. The next leaves are in whorls of 4, are similar to the cotyledons but are shorter, flatter and have a minute spine at tip. As the seedling grows, the juvenile leaves are opposite instead of in 4's, and gradually by transitional stages the branchlets bear the mature types of leaves.

Type Locality

"This fine cypress was discovered by the writer on the mountains back of Clifton in the extreme eastern part of Arizona, on the first day of September, 1880." Greene, Bull. Torr. Club 9: 64. 1882.

"Abundant specimens of wood, and fruiting branches were secured, and soon distributed, under the above name, to the principal herbaria of this country, and several in Europe, including that of the Royal Gardens at Kew."

Greene's herbarium is now deposited at Notre Dame University, South Bend, Indiana.

Range

United States. Arizona: Santa Catalina Mts., Pima Co.; Dragon and Chiricahua Mts., Cochise Co.; mountains north of Clifton (Blue Range), Greenlee Co. New Mexico: San Luis Mts., Hidalgo

Co. Texas: Chisos Mts., Brewster Co. Mexico: Extreme northeastern corner of Sonora, at north end of Sierra Madre, Sonora; Sierra Madre and Canelos, Río Mayo, Chihuahua; Sierra de Parrás, Coahuila.

Habitat

This species is confined to the Upper Sonoran Life Zone and to the lower borders of the Arid Transition Zone. It is usually found at elevations of 3000 to 5000 feet, but sometimes ranges considerably higher. At lower elevations it generally is in canyon bottoms and ravines, often near small streams, while at higher elevations it occupies ridges and slopes, particularly those with a northeast or northwest exposure. It is commonly associated with *Juniperus pachyphloea*, *Platanus Wrightii*, *Juglans rupestris* var. *major*, *Pinus edulis*, and *Quercus* spp. The soils in which it grows are mainly coarse and rocky of granitic or limestone formation, but sometimes are rocky clay or sandstone. In some localities the species forms groves constituting a major or dominant percentage of the local woody vegetation, while in other areas the trees occur as lone individuals mixed with numerous other woody species. Even the largest and densest stands known are of minor significance and extend for only a few miles and are thus hardly to be considered as forest trees.

Localities

1. Santa Catalina Mts., Pima Co., Arizona. *C. arizonica* has long been known from the Santa Catalina Mts., having been collected there first by C. G. Pringle, April 20, 1881 (Calif. Acad.). Sudworth (U.S.D.A. Misc. Circ. 92: 37. 1927) lists both *C. arizonica* and *C. glabra* for the Santa Catalina Mts., but I do not believe that the latter (*C. glabra*) occurs in the range. As far as is now known, *C. arizonica* occurs in but two localities in the Santa Catalinas as follows:

Bear Canyon. This is a canyon on the south side of the range, located about 4 miles due south of Bigelow Peak, and is reached by the Soldiers' Trail or Prison Camp Road, which when completed will join the road from Oracle to Mt. Lemmon. Reliable information obtained from Dr. Lyman Benson, then of the University of Arizona, indicated that Bear Canyon contains a rather considerable stand of cypresses. Unfortunately, on our visit to the Santa Catalina Mts., in October, 1942, we were unable to travel into Bear Canyon. Upon our arrival at the Federal Prison Camp, located about 2 miles below Bear Canyon, on October 2, 1942, we were about to be granted a permit to go into Bear Canyon when word came that two alien prisoners had escaped and had headed into Bear Canyon. This precluded permission being granted at that time, and we were unable to arrange our schedule to return later. However, on April

17, 1945, while in Tucson on other business, Drs. W. W. Wagener and J. L. Mielke went out to Bear Canyon where they obtained a fine set of specimens and made valuable notes as follows: "The grove extends along bottom and north-facing slope of canyon, 2.3 to 3.6 miles above Prison Camp on Solider Trail Highway (13.8 to 14.1 mi. from junction of Soldier Trail and Remington roads). Forms major part of stand on area of about 180 acres. Associates: *Pinus cembroides*, *P. leiophylla*, *P. arizonica*, *Juniperus pachyphloea*, *Quercus Emoryi*, and *Q. arizonica*. Also associated in canyon bottoms: *Alnus oblongifolia* and *Platanus Wrightii*. Largest specimen found measured 65 inches in diameter. Tallest specimens in canyon bottom 85-95 ft. high. Those on slopes mostly under 50 ft. in height. Trees tall and slender where crowded. Furrowed bark shows considerable spiral in many specimens."

The large tree mentioned above is probably the largest ever reported for this species and is also likely one of the largest wild trees known for any species of the genus.

Collection:

W. W. Wagener and J. L. Mielke, Coll. No. 11499, April 17, 1945. The fruiting branches, cones and bark specimens were taken from numerous individuals. The foliage ranges from practically non-glandular to conspicuously glandular; cone size is extremely variable as in other localities. The thick furrowed bark is typical of other stands of *C. arizonica*.

Sabino Canyon. This is a well known canyon, the ramifications of which head high on the slopes of Mt. Lemmon. In recent years it has been developed as a camp and recreation area by the U. S. Forest Service, and is readily accessible by a good paved road from nearby Tucson. The road ends (October 1, 1942) about 2 miles above the Caretaker's cottage at an elevation of about 3500 ft. Near the small stream at this point, we located one cypress tree bearing cones, and from it we obtained specimens. A hike up the canyon for at least a mile led us into trailless areas which were nearly impassable, and no other cypresses were located. It is probable that in earlier days there were additional cypresses in the vicinity of the fruiting specimen mentioned above, but they have been destroyed.

Sabino Canyon supports a varied plant population. Along the small stream are numerous specimens of *Platanus Wrightii*, *Salix Gooddingii* and *Fraxinus velutina*. On the adjacent canyon slopes, one of the most common shrubs is *Dodonaea viscosa* var. *angustifolia*. Other shrubs are *Jatropha cardiophylla* and *Erythrina flabelliformis*. At not greatly lower elevations are numerous *Fouquieria splendens*, *Acacia* sp., *Larrea divaricata*, *Prosopis velutina* and *Cereus giganteus*. In terms of Life Zones, Sabino Canyon at the point where

the cypress grows is at the lower edge of the Upper Sonoran Life Zone. The soil of the area is granitic with huge rocks on every side and coarse gravel in the canyon bottom.

Collections:

a). Marcus E. Jones, Aug. 20, 1903 (Pom., Calif. Acad.). b). C. B. Wolf and P. C. Everett, Coll. No. 11299, October 1, 1942. Tree 8 m. high, 5 m. spread, and a trunk 3.5 dm. in diam. at ground, with a straight central axis. Foliage dull, gray-green; cones remaining closed for several seasons; bark of main trunk rough and fibrous for first 5 m. above ground, then smooth, reddish, and exfoliating; bark of branches smooth, gray-red, but not polished; leaves with some active glands, others inactive, and some leaves without visible glands.

3. Chiricahua Mts., Cochise Co., Arizona. Three areas of the Chiricahua Mts. are known to have stands of *Cupressus arizonica* as follows: Rucker Canyon, located in the southwest portion of the range; Cave Creek, on the east central portion of the range; and Bonita Canyon, in the northwest part of the range. It is more than likely that in the intervening areas within the Chiricahuas there are some additional stands of cypress, for much of the range has not yet been thoroughly botanized. The Chiricahua Mts. are a rather important range in southern Arizona; and, not only rise to considerable heights (Chiricahua Pk. 9795 ft.), but have considerable bulk as well and support a rather extensive coniferous forest with representatives of all of the genera known to Arizona, including at least four species of *Pinus*.

Rucker Canyon. This canyon is located in the southwest portion of the Chiricahua Mts. and lies in Township 29 South, Range 29 & 30 E., Gila and Salt River Meridians. It can be reached by road from the south from Chiricahua, a small station on the Southern Pacific Railroad, or from the west from Sulphur Springs Valley.

Collection:

Lake S. Gill 4 (Prop. No. 2358, our Rucker Canyon, Arizona Strain), Feb. 5, 1935, from 5 mi. above the Civilian Conservation Corps Camp. Tree 16 m. high, 11 m. spread, and a trunk 6 dm. in diam. growing in creek bottom in semishade in coarse sandy soil, the basic rock volcanic, associated with Live Oak, Apache Pine and Juniper. According to Dr. Gill, the seed production on this tree was sparse, but the reproduction beneath it was good. Examination of the herbarium material of this collection shows that only a few of the leaf glands are active, many are inactive, while a sizeable proportion of the leaves are without visible glands.

Cave Creek. This area of the Chiricahua Mts. is fairly well known for its scenic beauties, particularly for its magnificent formations of huge rocks such as "Cathedral Rock". Cave Creek is reached

from the south and east by driving in from Rodeo, New Mexico, or from the northwest via a fine mountain road which crosses the range from the Chiricahua National Monument. Most of the cypresses on Cave Creek are in Township 28 South, Range 31 East, Gila and Salt River Meridian, but a few extend into the next township to the north (Township 27 South, Range 31 East). Many splendid specimens of *C. arizonica* are located along Cave Creek from just above the Paradise Ranger Station in the lower end of the Canyon for several miles up the creek, which has a small, all-year flow. They range in elevation from about 5000 to 5500 ft. Practically all of the cypresses are on the flats near the creek, and their roots must extend into moist gravel at all times. Lining the creek and associated with the cypresses are *Platanus Wrightii*, *Juglans rupestris* var. *major*, *Populus Fremontii*, and *Quercus* spp. at the lower end of the canyon, while at the upper limits of the cypresses there are numerous *Pseudotsuga taxifolia* and *Pinus arizonica*.

It is probable that the total number of cypress trees (exclusive of small saplings not yet producing cones) in the Cave Creek watershed is only a few hundred of which some are as fine specimen trees as are to be found anywhere for this species.

Collections:

a). C. B. Wolf and P. C. Everett, Coll. No. 11368, October 4, 1942, from along Cave Creek about $\frac{1}{2}$ mile above the Paradise Ranger Station, 5000 ft., growing in the creek bed near water. Tree 8 m. high, of 6 m. spread, and a trunk 4 dm. in diam. This tree dull, gray-green in aspect. Bark of main trunk rough and dark brown, not exfoliating, but also not stringy or really fibrous, a lot like that of *Juniperus pachyphloea*, which grows here too. Ovulate cones gray to purplish in color beneath the bloom; some appear to open within two or three years after maturity, while others remain closed for five or six years. b). C. B. Wolf and P. C. Everett, Coll. No. 11369, October 4, 1942, along Cave Creek at Idlewilde Public Camp, 5000 ft., growing in gravel at east bank of creek. Tree 18 m. high, 8 m. spread, trunk 6 dm. in diam. This is a tall, straight tree with a slender pyramidal crown and looks a great deal like a Douglas Fir from a distance except that its foliage is a dull, dusty-green, not greatly different from that of *C. Sargentii*. This appears to be an old, over-mature or decadent individual with the fibrous bark extremely thick, the branches with a dull, not polished, smooth brown, exfoliating bark and numerous old open cones on the branches. c). C. B. Wolf and P. C. Everett, Coll. No. 11380, October 5, 1942, along Cave Creek, $1 \frac{4}{10}$ mi. above Paradise Ranger Station, at junction with South Fork of Cave Creek Road, 5300 ft., growing on a moist flat in rocky humus. Tree 12 m. high, 5 m. spread, and a trunk 4.5 dm. in diam. at ground. This is a fine, straight tree, some-

what blue-gray-green in aspect. The bark is already becoming rough, fibrous and longitudinally fissured on the main trunk, it is dark gray-brown on the surface and dark brown in the crevices. Bark of branches exfoliating, leaving a clean, smooth, rich brown surface. d). C. B. Wolf and P. C. Everett, Coll. No. 11381, October 5, 1942, $\frac{1}{4}$ mi. below So. Fork Forest Service Public Camp, 5500 ft. Tree 25 m. high, 11 m. spread and a trunk 8 dm. in diam. at 1 m. above ground. In aspect this tree is a dusty-green about like typical trees of *C. Sargentii*. Bark of trunk longitudinally fissured, thick and fibrous, gray-brown on surface, but dark brown beneath. Bark of branches exfoliates leaving a smooth, deep red-brown surface. This is the finest and largest cypress noted in the Cave Creek area.

Bonita Canyon. A large portion of Bonita Canyon (Spanish for beautiful) is now a part of the Chiricahua National Monument, established largely because of the beautiful rock formations. It is located in the northwest portion of the Chiricahua Mts. and is largely in Township 26 South, Range 29 East, Gila and Salt River Meridian. The stands of cypresses extend from below the Faraway Ranch headquarters, at the mouth of the canyon, to nearly 2 miles above the National Monument Headquarters; a distance of several miles and an altitudinal range of from about 5000 to 5500 ft. In many parts of the canyon, the cypresses form pure stands, but are mainly confined to areas rather close to the small creek and do not appear to extend up onto the canyon sides. Pinery Canyon, which joins Bonita Canyon below the Faraway Ranch, has been given as a locality for *Cupressus*, but it is probable that the collections came from Bonita Canyon. While I was in this region in October, 1942, I followed Pinery Creek for several miles and did not see a single cypress.

Although *C. arizonica* is practically the dominant tree in the bottom of Bonita Canyon, the number of trees is only a fraction of the total present in the Clifton area. However, there are many beautiful specimen trees of this species which are, perhaps, as fine as can be seen anywhere. A particularly beautiful example is shown in Plate 11 of Kearney and Peebles, Flowering Plants and Ferns of Arizona (Misc. Publ. 423. U. S. Dept. Agric. 1942). Specimen trees such as this one were probably the basis of *C. arizonica* var. *bonita*, described from this canyon by Lemmon. Such outstanding, graceful trees represent only a fraction of the total population and are about equally common in the Clifton area. There are two specimens in the University of California Herbarium, supposedly collected by Lemmon on Sept. 21, 1881, on the summit of the Chiricahua Mts. These are the only known specimens of cypress from this range by Lemmon, so that if he did take a specimen from Bonita Canyon it is possibly lost or else may be one of these two.

Collections:

a). *L. S. Gill*, No. 2 (our *Prop. No. 2357*), Feb. 4, 1935, from Faraway Ranch, Bonita Canyon, 5000 ft. Tree 12 m. high, 10 m. spread, and a trunk 5 dm. in diam. Many of the leaves are without visible dorsal glands, while most of the others appear to be inactive. Well laden with nearly mature staminate cones. b). *C. B. Wolf and P. C. Everett*, Coll. No. 11385, October 5, 1942, from 1 6/10 mi. above the National Monument Headquarters. This is a bark specimen only, taken from an old dead tree about 25 m. high and a trunk 1.3 m. in diam. This is probably the largest tree in Bonita Canyon and has been dead for many years. Its thick, fibrous bark is bleached to a light gray. c). *C. B. Wolf and P. C. Everett*, Coll. No. 11386, October 5, 1942, from same spot as Coll. No. 11385. This is a typical cane 4 m. high, 3 dm. spread and a trunk 4 cm. in diam., taken from a thicket where the young trees grow about 3 or 4 dm. apart. As a result, they are very slender. They still have exfoliating smooth red-brown polished bark. Wood sample taken from ground level shows approximately 37 annual rings, with no apparent distinction between heartwood and sapwood. In general characteristics, these thickets of small trees are remarkably like those of *C. Forbesii* in the Santa Ana Mts., Orange Co., California. d). *C. B. Wolf and P. C. Everett*, Coll. No. 11387, October 5, 1942, from 3/10 mi. above the National Monument Headquarters. Tree 13 m. high, 8 m. spread, and a trunk 4.5 dm. in diam. This is a beautiful, gracefully branched specimen with a well developed crown. The foliage is fairly gray; most leaves bear a dorsal gland, but this is not very conspicuous and only a few are active. The bark of the trunk is gray and fibrous; that of the branches smooth, red-brown, exfoliating. Ovulate cones are abundant. e). *C. B. Wolf and P. C. Everett*, Coll. No. 11388, October 5, 1942, from 1/2 mi. below (W. of) Faraway Ranch. Tree 10 m. high, 6 to 7 m. spread, and a trunk nearly 1 m. in diam. at ground, but branching into 5 main branches each about 3 dm. in diam. This specimen stands on an open flat and has a well developed, open crown with very gray foliage. Most leaves bear an active gland, many of which have a conspicuous dot of dried whitish resin. Ovulate cones very abundant, glaucous-gray. Bark of trunks rough and fibrous, but not as gray in color as the trunks of most trees higher up the canyon. f). *C. B. Wolf and P. C. Everett*, Coll. No. 11389, October 5, 1942, adjacent to Coll. No. 11388 (above). Tree nearly 11 m. high, nearly 7 m. spread, a trunk about 8 dm. in diam. at ground, then forking into 3 trunks each 3 to 4 dm. in diam. This tree quite green in aspect (compare with Coll. No. 11388 above). Most leaves with a visible dorsal gland, but mainly inactive.

4. Stronghold Canyon, Dragoon Mts., Cochise Co., Arizona. This small range of mountains lies to the west of the Chiricahua Mts.

and forms part of the western boundary of Sulphur Springs Valley. According to the U. S. Forest Service map of the Coronado National Forest, issued in 1940, there are two canyons in the Dragoons similarly named, except that the one on the west side is called Stronghold Canyon West, while the one on the east is called Stronghold Canyon East. We are here concerned with the latter which lies mainly in Township 17 South, Range 23 East, Gila and Salt River Meridian. The canyon gets its name because Cochise, an Indian chief, used it as a hideout, and at its head there is now a Memorial Park and camp ground, located at about 5000 ft. elevation. The cypresses are scattered in the vicinity of the Memorial Park, ascending nearly to the summit of the range, and also down the canyon for about 1.5 miles. Around the camp and above it, the cypresses are mixed with *Quercus* spp., *Arbutus arizonica*, and *Juniperus pachyphloea*. Below camp, where the trees are largely lone individuals confined to the immediate rocky stream bed, the principal tree associate is *Platanus Wrightii*. However, there is no real grove or thicket of cypresses, and I estimated that there are about 200 trees over 7 m. in height in the canyon. A few of the trees are nearly 13 m. high, but most of them are less than 10 m. high; and few, if any, are as beautiful as some of those in Bonita Canyon in the Chiricahua Mts.

The United States Forest Service ranger at the Paradise Ranger Station in the Chiricahua Mts., who also has charge of the Dragoon Mts., reported to me that in addition to the cypresses in the vicinity of the Memorial Park, there was also another stand on the west slope of the range, or about 2 to 3 miles northwest of the Memorial Park. Because of lack of time, we did not attempt to verify this.

Collections:

a). C. B. Wolf and P. C. Everett, Coll. No. 11392, October 6, 1942. Tree 9 m. high, 4 m. spread, and a trunk 4.5 dm. in diam. at ground. This tree with dull gray foliage; most leaves with a visible dorsal gland, but only a very few are active. Ovulate cones few. Bark of main trunk rough and fibrous, almost black, with upper one-third of trunk with smooth, exfoliating, red-brown bark, like that of the branches. b). C. B. Wolf and P. C. Everett, Coll. No. 11393, October 6, 1942. Tree 10 m. high, 5 m. spread, and a trunk 3.5 dm. in diam. This tree is comparatively green in aspect, and most of its leaves have visible dorsal glands, about half of which are active. c.) C. B. Wolf and P. C. Everett, Coll. No. 11394, October 6, 1942. Tree 9 m. high, 6 m. spread, and a trunk 4 dm. in diam. at the ground. This tree dull, gray-green in aspect (about the color of a typical tree of *Cupressus Sargentii*). Many of the leaves are without dorsal pits, and only a few are active. Bark is very dark, a blackish-gray.

5. Mountains north of Clifton, Greenlee County, Arizona. The

mountains to the north of Clifton are variously known as the Big Blue Mts. or Blue Mts. Clifton, located in southeastern Arizona, is an important copper mining community, and the vegetation on the nearby hills shows the effects of the fumes from the early smelters. It was in this area that Dr. E. L. Greene collected the type specimen of *Cupressus arizonica* on September 1, 1880. However, he made no mention in his published account as to how far from Clifton he had gotten his specimens, or as to how extensive were the stands of cypresses. Undoubtedly, the present day appearance of the hillsides near Clifton is greatly different from that presented to Greene more than sixty years ago, for in the intervening years probably nearly every tree of any size close to Clifton was removed for lumber, mining timbers, or fuel.

The Coronado Trail (U. S. Highway No. 666) leads north from Clifton through a narrow and rocky canyon, the sides of which are littered with old and new mining equipment and workings. The place called Metcalf, shown on most maps and about six miles north of Clifton, is nothing more than a few stone foundations and the remains of old mines along the narrow canyon. About a mile above Metcalf, the scars of mining become less noticeable, and soon they disappear entirely. The first cypress trees which we noted along this road were about 8 miles above Clifton at approximately 4000 ft. elevation. From this point on to about 18 miles north of Clifton (by road), or $2\frac{1}{2}$ mi. above Cherry Lodge, cypresses were more or less continuous. Below Cherry Lodge there were many small clumps of cypresses in sheltered ravines, but the real stands were above the lodge where entire hillsides were given over to almost pure stands. Although we could rather readily determine the north and south extent of the cypresses in this area as approximately 8 miles airline, the east and west limits were not easily ascertained because of lack of roads and the rugged nature of the area. With a small telescope, we were able to determine that in several areas along the highway above Cherry Lodge, the cypresses extended to the west for several miles. We estimated that, because of the extensive nearly pure stands of cypresses, there were several hundred thousand trees, possibly more individuals than in all of the other Arizona stations for this species.

For the most part, the trees in the ravines and canyons were 10 to 13 m. high, while in many places on exposed ridges there were thickets of dwarfs often bearing cones when 2 to 3 m. high.

At the lower limits of distribution of cypresses in the Clifton area, they are associated with *Platanus Wrightii* and *Quercus* spp., while higher up there are *Pseudotsuga taxifolia*, *Pinus edulis*, *Garrya Wrightii*, *Cercocarpus betuloides* and *Arctostaphylos Pringlei*.

The cypress trees of the Clifton area are mainly dull, dusty-green in aspect, but some young trees and an occasional large individual are blue-glaucous. A few trees have graceful, drooping

branches and from a distance resemble Douglas Firs of equal size. These graceful specimens are like those outstanding individuals in Bonita Canyon in the Chiricahua Mts., and appear to be produced largely because the individual tree is advantageously situated as to soil and moisture, and not because it is an inherited character.

Because of the tremendous number of individual cypresses and the diversity of habitats which they occupy, the Clifton area is probably the most ideal station to study the variability of this species. The bark of the main trunks of the trees is of particular interest because of the stages through which it passes as follows: 1). on very small trees with trunks less than 1.5 dm. in diam., the bark exfoliates leaving a smooth, cherry-red or mahogany-brown surface; 2.) on trees with trunks 1.5 to 3 dm. in diam., the bark is rough, curling into irregular plates but does not exfoliate completely, and is not yet fibrous or stringy as in the next; 3). on trees with trunks over 3 dm. in diam., the bark is rough, and fibrous, longitudinally furrowed and is gray or sometimes nearly black, is often 5 to 6 cm. thick on old individuals and does not exfoliate. Occasionally medium sized trees retain a bark somewhat like that described under 2)., above, and which somewhat resembles that of *Juniperus pachyphloea* and has been termed "alligator-barked". For an example, see Collection No. 11406 below and also No. 11428 from northwest of Pine, of *C. glabra*. This characteristic was first pointed out by Kearney and Peebles (Flowering Plants and Ferns of Arizona, U. S. D. A. Misc. Publ. 423: 67. 1942).

While we were making our collections in the Clifton area, we talked with a road crew foreman who had lived in the region the greater part of his life. He told us that he had been over nearly every square mile of this region, and that the extent of the cypresses was essentially that indicated above, and that he knew of no other groves or stations in this region.

Collections:

a). C. B. Wolf and P. C. Everett, Coll. No. 11405, October 7, 1942, from 9 6/10 mi. north of Clifton at 4000 ft. elevation. Tree 11 m. high, 5.5 m. in spread, and a trunk 3 dm. in diam. at 1 m. This is a beautiful specimen growing in a canyon bottom associated with *Platanus Wrightii* and *Quercus* spp. It has somewhat weeping branches, a medium gray-green crown of foliage, and a straight central axis, the bark of which is fibrous gray-brown and longitudinally furrowed. Many of the branches have leaves without visible dorsal glands, while others have glands on almost every leaf, of which very few are active. b). C. B. Wolf and P. C. Everett, Coll. No. 11406, October 7, 1942, from 2 3/10 mi. above Cherry Lodge, or approximately 17½ mi. north of Clifton, at 6000 ft. elevation. This is a characteristic medium-sized tree of this area with a height of 8 m.,

a spread of 5 m., and a trunk 3.5 dm. in diam. at the ground. The main trunk has somewhat "alligator-like" bark which is almost black. In aspect the tree is a dull, dusty, gray-green. Less than one-half of the leaves have visible dorsal glands, of which only an occasional one is active. c). C. B. Wolf and P. C. Everett, *Coll. No. 11407*, October 7, 1942, from same locality as *Coll. No. 11406*. This is a sapling from the thickets along the limestone ridges and is about the maximum size which has exfoliating smooth, cherry-red bark on the main trunk. Tree 4 m. high, spread 6 dm., and a trunk a little over 1 dm. at the ground. A wood sample taken from 1 dm. above the ground shows approximately 85 annual rings, indicating the extremely slow growth made by these trees under these conditions. Less than one-half of the leaves have visible dorsal glands, and of these only an occasional one is active. The foliage is a dull, dusty-green and is not at all glaucous. The trees on these sterile, rocky ridges are all of this color, and it is only in the sheltered canyons and in better soil that the fine specimens with glaucous-gray or blue foliage and graceful, drooping branches are produced. d). C. B. Wolf and P. C. Everett, *Coll. No. 11408*, October 8, 1942, from same locality as *Coll. No. 11407*. Tree nearly 11 m. high, 5.5 m. spread, and a trunk 6 dm. in diam. This tree is growing on an exposed ridge and appears to be an exceptionally old over-mature individual with a sparse, wind-swept, rounded crown. Many of the branches are dead, and the first live ones are about 4 m. from the ground. The bark of the trunk is dark gray, nearly 3 cm. thick, fibrous and furrowed. The foliage is a dusty, gray-green, with about one-half the leaves with visible glands, of which only an occasional one is active. e). C. B. Wolf and P. C. Everett, *Coll. No. 11409*, October 8, 1942, growing adjacent to *Coll. No. 11408*. Tree 6.5 m. high, with 3 m. spread, and a trunk 2 dm. in diam. This tree, along with several others, was pushed out of the rocky soil by a road crew with a tractor while we were making our collection in this area. The main root system of the individual was practically uninjured in the process and consisted of four or five roots, the largest of which was about 1 dm. in diam., and at a distance of 2 m. from the root crown became quite small. The foliage is a dull, dusty-green. Most leaves have a visible dorsal gland, of which only an occasional one is active. The fairly numerous cones are conspicuous because of their prominent umbels and their purplish or bluish-glaucous surface. The main trunk has rough, scaly bark, with a dark gray to nearly black surface. A section of the trunk taken from about 2 m. above the ground is 13.5 cm. in diam. and has approximately 120 annual rings, with no visible differentiation between heartwood and sapwood. On this basis, *Coll. No. 11408* growing only a short distance away would be about 500 years old.

6. Santa Rita Mts., Santa Cruz Co., Arizona. This locality is apparently based on a collection by C. G. Pringle, which I have not

seen. Reference to this range has been noted as follows: Sarg., *Silva* No. Am. 11: 105. 1896; Mast., *Journ. Linn. Soc.* 31: 340. 1896; Sudw., *U. S. D. A. Misc. Circ.* 92: 37. 1927. In October, 1942, we visited the Santa Rita Mts. and rather carefully explored White House or Madera Canyon, where the cypresses were supposed to occur, but were unable to locate any. Dr. Lyman Benson, formerly of the University of Arizona, who has collected numerous times in the Santa Rita Mts., expressed doubts to us that there were any cypresses in the range. He also doubted that cypress collections had been obtained from the Huachuca Mts. listed below.

7. Huachuca Mts., Santa Cruz Co., Arizona. Bear Canyon in the Huachuca Mts. has also been supposed to have cypresses; but when we visited it in October, 1942, we were unsuccessful in locating a single tree. Just south of Bear Canyon is the D'Albini Ranch, and Mr. D'Albini told us that he had lived there most of his life and had ridden after cattle over nearly every foot of the Huachuca Mts. without ever having seen a cypress tree. He was familiar with cypresses, for he told us that we would find plenty of them in the Chiricahua Mts. This convinced us that he was not confusing cypresses with junipers, a common mistake, especially since we were able to show him recently gathered herbarium specimens of *C. arizonica*.

8. Pinaleno Mts., Graham Co., Arizona. Goudy Canyon, located back of old Fort Grant is also a supposed locality for cypress, but we thoroughly explored this canyon in October, 1942 without finding a single cypress.

9. San Luis Mts., New Mexico. This is a small range of mountains in extreme southwestern New Mexico in Hidalgo County and is only a few miles northeast of the Sonora, Mexico locality cited below.

Collection:

E. A. Mearns 560, July 26, 1892 (Dudl. Herb.).

10. San Francisco Mts., Catron Co., New Mexico. This locality reported by Sudw., *U. S. D. A. Misc. Circ.* 92: 37. 1927. We have not seen herbarium specimens from this western New Mexico range of mountains which lies a short distance to the east of the Clifton, Arizona station. Several authors in citing cypress localities have confused this range with the San Francisco Mts. of Arizona, located near Flagstaff. However, all who are the least bit familiar with the latter range in Arizona concede that no cypresses occur upon it.

11. Chisos Mts., Brewster Co., Texas. This is the only recorded area for cypress in Texas and is of interest in that it represents the extreme eastern locality for any cypress in the United States.

Collections:

a). R. S. Ferris and C. D. Duncan 2725, July 15-18, 1921 (Dudl. Herb., Calif. Acad.). Upper Juniper Canyon at 6000 ft. The specimen deposited at Stanford has a good photograph attached which shows the rough, fibrous, non-exfoliating bark so characteristic of the species. b). J. A. Moore and Steyermark 3207, June 22, 1931, (Dudl. Herb., Calif. Acad.). Valley above Boot Spring, 2200 m. "Tree 50 to 75 ft., 1 to 3 ft. in diam.", also E. J. Palmer 34177, May 25, 1928 (Calif. Acad.), from Boot Spring.

12. Northern end of the Sierra Madre, Sonora, Mexico, in "Devil's Canyon", located about 3 miles southwest of the U. S.-Mexico Boundary Monument No. 66. This area is reached by driving to the south end of Animas Valley in southwestern New Mexico. The cypresses grow at an elevation of about 5500 ft. in association with *Rhamnus betulaeifolia*, *Acer floridanum*, *Pinus cembroides*, *Ptelea tomentosa*, *Quercus hypoleuca*, *Prunus virens*, *Fraxinus papillosa*, *Arbutus arizonica* and *Arctostaphylos pungens*. Although it has been a number of years since I collected in this area and I was not primarily interested in cypress at the time, I do recall that the cypress trees were scattered and did not form a grove or thicket.

Collections:

a). C. B. Wolf, No. 2562, July 8, 1928 (Dudl. Herb., U. C., R. S. A., Calif. Acad.). Tree 23 m. high, and a trunk 4.5 dm. in diam., with a rough, gray, fibrous, fissured bark. Most of the leaves bear indistinct dorsal glands, only a few of which exude resin. b). C. B. Wolf, No. 2564, July 8, 1928 (Dudl. Herb., R. S. A., Calif. Acad.). Tree 8 m. high, and a trunk 2 dm. in diam. with rough, gray, fibrous bark. Most leaves bear indistinct dorsal glands, only a few of which exude resin. Young ovulate cones are very blue-glaucous and bear prominent horns; mature cones are gray-brown and bear rather inconspicuous horns.

13. Guayanopa Canyon, Sierra Madre, Chihuahua, Mexico, at 5000 ft.

Collection:

M. E. Jones, Sept. 23, 1903 (Pom., Dudl. Herb., Calif. Acad.).

14. Canelos, Rio Mayo, Chihuahua, in the Transition Zone in pine canyons. A large tall tree scattered infrequently along the water courses of the high Sierras.

Collection:

H. S. Gentry 2005 (U. C.).

15. Sierra de Parrás, 9-10,000 ft. Coahuila, Mexico.

Collection:

G. A. Purpus 4987, Oct., 1910 (U. C.). Most of the leaves of this collection bear indistinct glands, but only a few are active.

Collections of Cultivated Specimens

a). P. C. Everett, Coll. No. 7819, May 19, 1936; seedlings of Prop. No. 2357, from 4 in. pots in Garden nursery, seed flats planted March 28, 1935; 15-20 cm. high, with juvenile spreading leaves and some cotyledons still present; fine root system. b). P. C. Everett, Coll. No. 7820, May 20, 1936; seedlings of Prop. No. 2358 from 4 in. pots in Garden nursery, seed flats planted March 28, 1935; 15-20 cm. high, with juvenile spreading leaves and some cotyledons still present; root system very well developed, with ample fibrous roots.

Relationships

Because of its widespread distribution, I have concluded that *C. arizonica* may well be regarded as the basic or parental species of a group consisting of *C. glabra*, *C. nevadensis*, *C. Stephensonii* and *C. montana*. Of these *C. nevadensis* and *C. montana* have fibrous bark on the main trunks of mature trees, but the former is much more glandular-leaved. *C. glabra* generally has much more active leaf-glands than *C. arizonica* and also usually retains its cherry-like bark throughout life. Foliage of *C. Stephensonii* is, on the whole, less glandular than that of *C. arizonica* but is equally harsh or coarse. However, its bark is smooth and never fibrous. Perhaps, it would be more reasonable to suggest that all of these species have arisen from a common parental form which is not now represented by living plants.

References

CUPRESSUS ARIZONICA Greene, Bull. Torr. Club 9:64. 1882. Original description of species, see quotations under Type Locality in text. 2). Sarg., Silva No. Am. 11: 105. Tab. DXXVI. 1896, in part. Sargent reduces *C. arizonica* var. *bonita* Lemm. to synonymy, and corrects his reference of *C. guadalupensis* given in For. Trees No. Am. 10th Ann. Rep. U. S. IX. 1890. He did not, however, detect the differences between *C. arizonica* and the much later described *C. glabra*, for he gives the range of the former species as including Pine and Natural Bridge, both of which are stations for *C. glabra*. 3). Beissn., Handb. Nadelh. 2: 579. 1909. *C. Bentharii* Endl. var. *arizonica* Mast. is listed as a synonym. 4). Elwes & Henry, Trees of Great Brit. & Irel. 5: 1183. 1910, in part. *C. guadalupensis* Sarg., not Wats., and *C. Bentharii* var. *arizonica* are listed as synonyms. The range is given as central, southern and eastern Arizona, Sonora and Chihuahua. The first of these (central Arizona) is for *C. glabra* Sudw. 5). Camus, Les Cyprés 57. 1914. In this monograph of the genus *Cupressus*, the author's concept of *C. arizonica* is correct, but her geography appears confused, and her reference to this species in the San Francisco Mts., Arizona most

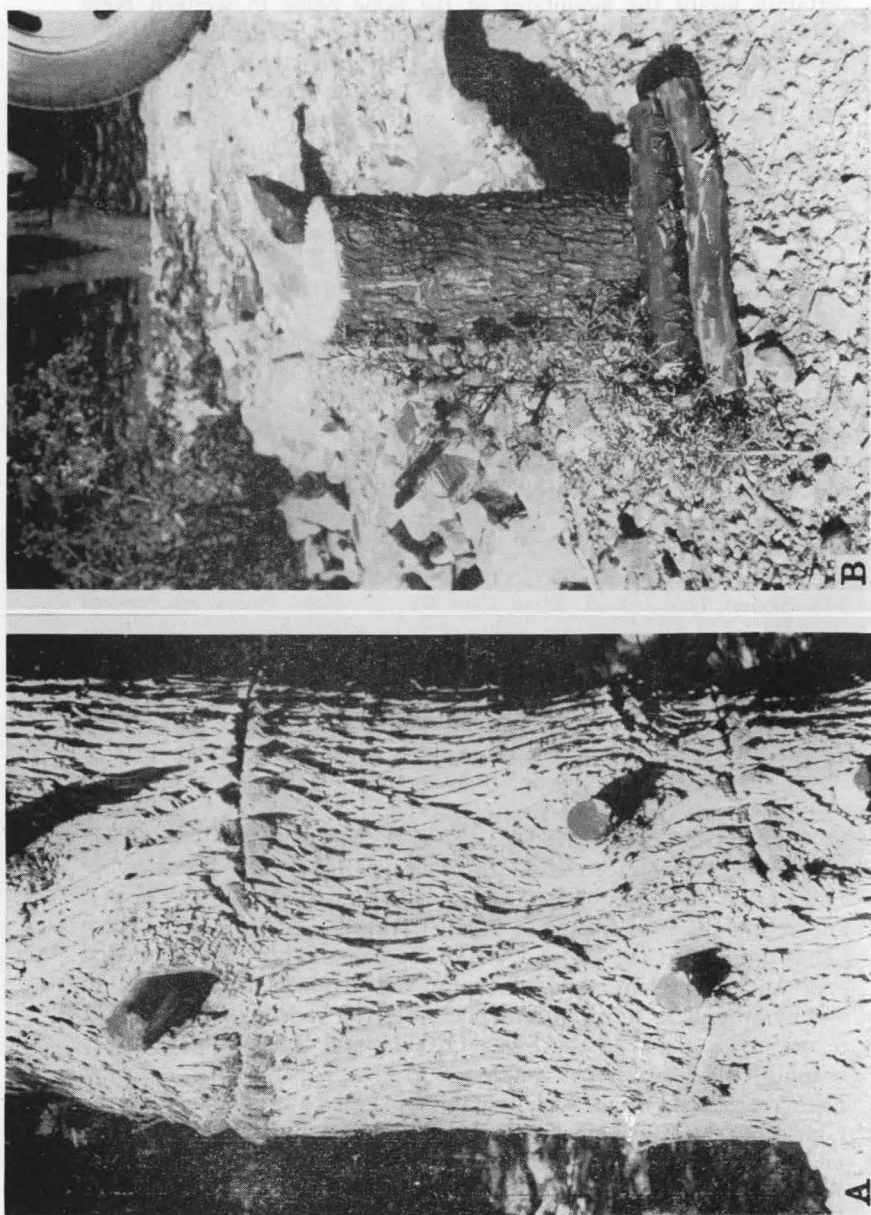


FIGURE 23. *Cupressus arizonica*.

certainly means the mountains of the same name in western New Mexico. 6). Woot & Standl., Contrib. U. S. Nat. Herb. 19: 35. 1915. In this paper, a flora of New Mexico, the authors cite the San Luis Mts. as the only New Mexican locality for the species (Mearns 437, 560, 2244). 7). Standl., Contrib. U. S. Nat. Herb. 23: 63. 1920, in part. The range of this species is given as "Coahuila to San Luis Potosí, Zacatecas and Baja California". The latter is, presumably, based on specimens from the Sierra San Pedro Martir, and which have since been described as *C. montana* Wiggins. 8). Dalli. & Jacks., Handb. Conif. 193. 1923, in part. These authors state: "This is probably a northern form of *C. lusitanica*, but is readily distinguished by its greyish foliage and the glandular pits on the leaves exuding a whitish resin." They also say: "It was introduced into England in 1882 from the Arnold Arboretum, and only small trees are known in this country." They call it "Red-Barked Cypress" or "Arizona Red-Barked Cypress" and say: "Most of our cultivated plants have conspicuously glandular leaves and, therefore, belong to *C. glabra* as defined by Sudworth." 9). Rehd., in Bailey, Cult. Evergr. 210. 1925. Rehder states that it is doubtful if this species is in cultivation. 10). Sarg., Man. Trees No. Am. ed. 2. 73. 1926. Sargent's characterization and distribution are correct for this species. 11). Sudw., U. S. D. A. Misc. Circ. 92: 37. 1927. Sudworth reports this species as present in the Santa Rita Mts., Arizona. We have not been able to verify the occurrence of this or any cypress in that range, although others besides Sudworth have also listed cypress from it. 12). Van Dersal, Nat. Woody Pl. U. S. 114. 1938. The statement that the plant has been much spread by cultivation is in error, for the Arizona Cypress of horticulture is *C. glabra*. Also, the citation of Masters as the original author is a mistake. 13). Tidest. & Kittel, Fl. Ariz. & New Mex. 5. 1941. The authors of this flora have correctly interpreted *C. arizonica* Greene. 14). Kearney & Peebles, U. S. D. A. Misc. Publ. 423: 67. pl. 11. 1942. This is apparently the first treatment of the cypresses of Arizona in which *C. arizonica* Greene and *C. glabra* Sudw. are properly evaluated and the much-confused *C. arizonica* var. *bonita* Lemm. placed in synonymy under *C. arizonica*. Their reference to Sudworth's (1927) report of *C. glabra* in the Santa Catalina and Santa Rita Mts. has been discussed under the reference to that paper. Their excellent plate reproduced from a photograph by Peebles in Bonita Canyon, Chiricahua Mts., Arizona is characteristic of many trees in that area which have had ample space for full development. 15). Little, Am.

FIGURE 23.

CUPRESSUS ARIZONICA—Arizona Cypress.
Clump of trees in Bonita Canyon, Chiricahua National Monument, Cochise Co., Arizona. The tallest trees are about 22 m. high. Made from a Kodachrome (No. 280), taken Oct. 5, 1942.

FIGURE 24. *Cupressus arizonica*. See opposite page.

Jour. Bot. 31: 592. 1944, in part. *C. arizonica* var. *bonita* Lemm. and *C. glabra* Sudw. are listed as synonyms. For a discussion of Little's treatment, see this same reference as listed under *C. glabra* Sudw.

CUPRESSUS ARIZONICA var. *BONITA* Lemm., West. Am. Cone-bearers. 3rd ed. 76. 1895. This variety was described from Bonita Canyon, Chiricahua Mts., southeastern Arizona. Lemmon called it "Beautiful Cypress". 2). Lemm., Sierra Club Bull. 4: 118. 1902. In this paper on the conifers of the Pacific Slope, Lemmon reports that he and his wife discovered a grove of cypress at the mouth of Bonito Canyon, Chiricahua Mts., in June, 1881. Thus, the Lemmons were only nine months behind Greene in the discovery of the Arizona Cypress, although publication was thirteen years later. Lemmon's spelling of the varietal name *bonito* instead of *bonita* appears to have been deliberate, for he also calls it "Bonito Cypress". 3). Sarg., Man. Trees No. Am. ed. 2. 74. 1926, in part. The description and most of the distribution apply to *C. glabra* Sudw. which Sargent lists as a synonym. Only the "Chiricahua Mountains (J. W. Toumey, July, 1894)" and "Santa Rita and Santa Catalina Mountains" could be stations for genuine *C. arizonica*.

CUPRESSUS BENTHAMII var. *ARIZONICA* Mast., Journ. Linn. Soc. 31: 340. 1896. Based upon *Cupressus arizonica* Greene. Masters advanced no reasons for thus disposing of this species under *C. Benthamii*. It is of interest to note that Masters cited specimens by Lemmon from the Chiricahua Mts., thus indicating that he saw nothing about the material to distinguish it from other specimens of *C. arizonica*. It is unlikely that Masters had seen Lemmon's published account of var. *bonita*.

CUPRESSUS GLABRA Sudw., U. S. D. A. Misc. Circ. 92: 37. 1927, in part. His reference to this species in the Santa Catalina Mts., Arizona is certainly for *C. arizonica*, and to the Santa Rita Mts. likely to be proven so if ever verified.

FIGURE 24.

CUPRESSUS ARIZONICA—Arizona Cypress.

A—Trunk of tree at right in Figure 23. This over 1 m. in diam. at 2 m. above ground. Note the rough, fibrous, non-exfoliating bark characteristic of mature trees of this species. Made from a Kodachrome (No. 282), taken Oct. 5, 1942.

B—Material of Coll. No. 11409. The section of trunk was taken from 2 m. above ground, was 13.5 cm. in diam. and had about 120 annual rings. The branches have smooth, cherry-red, exfoliating bark. The cones shown were immature, had prominent horns and were glaucous (somewhat purplish). Made from a Kodachrome (No. 300), taken Oct. 8, 1942.

5. CUPRESSUS NEVADENSIS—Piute Cypress

Cupressus nevadensis Abrams, *Torreya* 19: 92. 1919. Erect tree seldom much over 10 m. high, forming an equally broad pyramidal crown with the straight trunk clothed with branches nearly to the ground; or in young trees dense and slender in habit with erect branches. Trunk 6 to 8 dm. in diam., the lower portion covered with a gray-brown, fibrous bark 1 to 2 cm. thick, but soon giving way higher up to a semi-cherry-red or brownish bark, which is also characteristic of the larger branches. Only occasionally does the bark of the upper portion of the trunk and that of the branches exfoliate, leaving a clean smooth red surface. Likewise on saplings with trunks under 5 cm. in diam. the bark is sometimes a smooth cherry-red. The general aspect of the trees is a soft gray-green, due to the glaucous surface of the leaves and to the whitish resin which accumulates from the exudation of the dorsal resin pits. Herbage only very faintly aromatic, even when crushed. During periods of active growth or wet weather, the trees appear greenish, but at the end of the long dry summer they are very gray. Branchlets evenly disposed on all sides of the branches, either alternate or opposite, standing out strongly, those of the season often unbranched for 20 mm., 1 to 1.5 mm. thick, distinctly 4-sided. Leaves about 2 mm. long, sharply acute, keeled or ridged on back with a conspicuous and active oval dorsal gland located slightly above the middle of the back of the leaf, and the dried resin of which forms a spot nearly 1 mm. long. In contrast to the species with closed glands on the leaves, these are visible on the terminal or at least the second pair of leaves of even the youngest branchlets, whereas, in the other species (*C. pygmaea*, *C. Goveniana*, etc.) they are not visible until the leaves are much older, or until after the branch has produced secondary branches. Margins of the leaves, particularly below the acutely tapering tip, are conspicuously fimbriate-ciliate as seen under a low power lens (10.5x). On vigorous branches the leaves enlarge and may become 8 to 12 mm. long, 3 to 4 mm. wide, have an acute-spreading tip. These leaves are usually of short duration and soon turn brown and are pushed off by the expanding bark of the branch beneath. Staminate cones produced abundantly, shedding their pollen in February and March; cones 3 to 5 mm. long, composed of 10 to 16 scales (mostly 12), each scale usually with 5 or 6 sacs. Ovulate cones borne solitary on tips of branchlets, but these usually aggregated in rather compact clusters of 15 to 25 cones covering 1 to 2 dm. of a larger branch. During the first season the cones are a rich light brown, but at maturity (the second year) are glaucous or even silvery-gray and remain closed and of this color for several years. The branch or stalk upon which the cone is borne is 10 to 15 mm. long, 2 to 3 mm. thick, in age devoid of the old leaves.

Cones 20 to 30 mm. long, usually considerably less in width, but occasionally globose, composed of 6 or 8 scales, the umbos of which are somewhat conical and pointed, but gradually weather away in age, those of the 2 upper scales much more pronounced and usually stand erect. Surface of cone a little warty due to the pitch pockets near the surface (never rough like in *C. Bakeri*). Seeds a rich light tan, the largest 5 mm. long, very irregularly shaped, the winged margin rather conspicuous, and the much lighter tan hilum often over 2 mm. long by 0.5 mm. broad. Visible under a lens, but usually not to the naked eye, the body of some seeds shows an echinate or slightly warty surface and a few are slightly glaucous. An 8-scaled cone had 93 seeds. In germination the 4 or 5 cotyledons push the seed coat above ground and then expand at nearly right angles to the main axis. Cotyledons linear, a little flattened, but blunt-tipped, often 15 mm. long. The next leaves are similar, but somewhat shorter and flatter, and have a minute spine at the acute tip, and are borne in whorls of 4; later the branches gradually produce transitional type leaves and eventually the mature type.

Type Locality

"It grows on Red Hill, Piute Mountains, near Bodfish, Kern County at an elevation of 5,000-6,000 feet, associated with the California Juniper, Blue Oak, Digger Pine and such desert plants as *Pinus monophylla* and *Ephedra viridis*. Type Abrams 5368, July 29, 1915." Abrams, *Torrey* 19: 92. 1919. The type specimen is deposited at the Dudley Herbarium of Stanford University, Sheet No. 93519. Isotype at Rancho Santa Ana Botanic Garden.

Range

United States. California. Kern County, where it is known mainly from the slopes of the mountains a few miles south of Bodfish, largely on the drainage system of Bodfish Creek, which is a small tributary of the Kern River; from a second locality a few miles E. of this location; and from a third station in Back Canyon, located south and east of Piute Peak; and, apparently, well isolated by several miles from the other two. Reports of additional stations for *Cupressus nevadensis* in Kern County have not, as yet, been substantiated by actual specimens, and I have searched for the trees in several such areas without success, but I have no doubt that some other stands in the Piute Mts. will be located.

Localities

1. Oscar Meier's Ranch, 3 miles southeast of Bodfish, on the drainage system of Bodfish Creek. In October, 1930, when I first

visited this area, I had the good fortune to find Mr. Meier at home. He related that for many years he had cut cypresses for fence posts and had, thus, reduced the stand somewhat in the area to the southwest of his house. A short distance away over a low ridge, there were some splendid shapely specimens scattered over the rocky red clay soil in association with *Juniperus californica* and *Pinus monophylla*. Some of these were so symmetrical and pyramidal that they were unrivaled in beauty by any wild cypress trees elsewhere in California. These trees were at the lower limit of the Bodfish stand (about 4000 ft. elevation) and did not form a grove or thicket.

Collections:

a). C. B. Wolf, *Coll. No. 1689 (Prop. No. 952)*, October 2, 1930, from a tree 10 m. high, 8 m. spread and a trunk nearly 4 dm. in diam. b). C. B. Wolf and E. R. Johnson, *Coll. No. 6203 (Prop. No. 2159, our Bodfish No. 1 Strain)*, October 20, 1934, from a tree 10 to 11 m. high, 10 m. in spread and a straight trunk 7 dm. in diam. at 1 m. One of the lower branches taken as a wood sample was 10 cm. in diam., had reddish, cherry-bark and approximately 97 annual rings c). C. B. Wolf and E. R. Johnson, *Coll. No. 6204 (Prop. No. 2160, our Bodfish No. 2 Strain)*, October 20, 1934, from a tree 9 m. high, 8 m. in spread and a trunk about 5 dm. in diam. at 1 m. Some of the larger branches of this tree had slightly cherry-red bark, but this not smooth or polished. A branch from near the ground was about 8 cm. in diam. and had 86 annual rings.

2. Red Hill, Piute Mts. This portion of the stand of *Cupressus nevadensis* is reached by driving south from Bodfish on the road to Havilah for about 3 miles to the summit of the grade. At this point a road leads off to the east to Piute Mt. It is unsurfaced, narrow and steep and because of the clay soil is impassable in wet weather. However, by walking or driving out along this road for about 2.5 miles, one comes to an extensive stand of cypresses which extends for at least a mile eastward, for considerable distance up the side of the mountain, and down the mountain to connect in a mile or two with the stand on Oscar Meier's Ranch. There are thousands of cypress trees in this area, few of which are over 10 m. high, the remainder being mainly 5 to 8 m. high. The trees are mostly grayish in aspect, but in February and March many are golden because of the great profusion of yellow staminate cones. Mr. and Mrs. A. K. Winslow, who own a ranch at the foot of the mountain, told me on March 5, 1943 that during the preceding two or three weeks strong winds had lifted great clouds of yellow pollen from the cypress trees, and that although they were from 1 to 2 miles away, were clearly visible.

Associated with the cypress trees at this higher station were *Pinus Sabiniana*, *Fremontia californica*, *Juniperus californica* and

Yucca Whipplei, but over a large portion of the area, the cypresses were practically in possession of the entire ground surface.

Collections:

a). C. B. Wolf, Coll. No. 11444, March 5, 1943, from a tree 10 m. high, 5 m. in spread, and a trunk 3 dm. in diam. Bark of trunk thick, dark gray-brown and fibrous. This tree extremely heavily laden with staminate cones. b). C. B. Wolf, Coll. No. 11445 (Series A to J), March 5, 1943. These specimens were taken from different trees to show the variability in cones and foliage. c). C. B. Wolf, Coll. No. 11446, March 5, 1943. This is a wood specimen only, cut near the ground from a sapling about 3 m. high, 6 dm. in spread and a trunk about 6 cm. in diam. at the ground. This is about the largest sapling which has a smooth cherry-red bark. Others in the immediate vicinity only a trifle larger have rough fibrous gray bark like the mature trees.

3. Other collections from this same area, but which cannot be definitely correlated with our own, are as follows:

a). L. R. Abrams 5368 (Type Set) Red Hill, near Bodfish, July 29, 1915, alt. 5,000 ft., cones glaucous within, as also the seeds (R. S. A., Dudl. Herb.); b). Leo Herzinger, August 30, 1907, from "About 65 miles N. E. of Bakersfield, near Piute Mt." (Dudl. Herb.); c). Miss L. A. Herzinger, March 18, 1911 (Jepson Herb.).

4. Back Canyon, Kern County. This locality is in the Piute Mts., and is at least 15 miles southeast of the Bodfish area. It was, apparently, discovered by R. St. John in 1931 while making a vegetative type map for the University of California, under the direction of A. E. Wieslander. The Back Canyon stand of cypresses is reached by driving along the Caliente to Claraville road to the mouth of Back Canyon, which is approximately 1.8 miles above the Sand Canyon Store or about 16.8 miles above Caliente. Turn up the Back Canyon road and drive for approximately 7 miles, at which point a small grove of Piute Cypress can be seen a few hundred feet to the south on a northeast hillside. This small and isolated grove consists of a few hundred trees, probably none of which is more than 10 m. in height. The area lies at about 4500 ft. elevation, is typical Upper Sonoran Life Zone with Douglas Oaks (*Quercus Douglasii*), Piñons (*Pinus monophylla*), Digger Pines (*Pinus Sabiniana*) and California Junipers (*Juniperus californica*). The soil is a mixture of decomposed granite and clay, is rather loose, but extremely sticky when wet. A rancher living at the lower end of Back Canyon told me (November 15, 1944) that he knew of the cypresses in the upper part of the canyon and also of those at Bodfish. In response to my questioning, he stated that he had lived there nearly his whole life and had ridden for cattle

over nearly every hillside but had never seen cypresses elsewhere in the region.

Collections:

a). R. St. John 241, 6/18/31 (U. C. Veg. Type Map Herb.). This locality is given on the label as: Back Canyon, Mojave Quad., Sect. 26, T30S, R34E. b). C. B. Wolf, Coll. No. 11490 (*Prop.* No. 5062) Nov. 5, 1944, from a tree 8 m. high, 8 m. spread and a trunk 5 dm. in diam.

6. Piute Mt., Kernville Quadrangle, Sect. T27S, R34E. If the survey designations given above are correct, then this locality is several miles to the east of the Bodfish stands described above, and could not be on Piute Mt. proper, since it (Piute Pk.) is in Sect. 36, T28S, R33E. Possibly, the collector meant Piute Mts.

Collection:

C. R. Clar 109, Aug., 1930 (U. C. Veg. Type Map Herb.).

Collections of Cultivated Specimens

P. C. Everett, Coll. No. 7797, May 19, 1936, seedlings of *Prop.* No. 2159, from 4 in. pots in Garden nursery, seed flats planted March and April, 1935; 5 and 6 cm. high, with juvenile spreading leaves; cotyledons still present; root system well developed.

Relationships

Cupressus nevadensis is an interesting species in that it appears to have its closest affinities with *Cupressus arizonica*. The gray, fibrous bark links it with *C. arizonica*, but its branches are practically without exfoliating smooth bark as in that species. Its active leaf glands are similar to those of *C. glabra*, but that species has cherry-red, exfoliating bark on its trunk as well as its branches. Its closest relative in California appears to be *C. Bakeri*, but that species is well separated by its much slenderer branchlets, small cones and strictly non-glaucous seeds. *C. montana* of Baja California has similar bark but is much less glandular and has smaller cones that open soon after maturity.

References

CUPRESSUS NEVADENSIS Abrams, *Torreya* 19: 92. 1919. Original description, for quotation see Type Locality in text. 2). Jepson, *Man. Fl. Pl. Calif.* 58. 1923. 3). Wiggins, *Contrib. Dudl. Herb.* 1: 163. 1933. Wiggins, in discussing *C. montana*, compared it with *C. nevadensis* Abrams stating that the cones and bark of older trunks suggest a relationship, but that the staminate cones of *C. montana* are larger, the seeds are not glaucous and the leaves are

more acute and noticeably longer than they are in *C. nevadensis*.

CUPRESSUS MACNABIANA Rehd., in Bailey, Cult. Evergr. 209. 1925, in part. *C. nevadensis* Abrams is listed as a synonym. 2). Sarg., Man. Trees No. Am. 2nd ed. 72. 1926, in part. *C. nevadensis* Abrams is listed as a synonym, and its locality in Kern Co., Calif. is cited. 3). Sudw., U. S. D. A. Misc. Circ. 92: 37. 1927, in part. *C. nevadensis* Abrams is listed as a synonym. 4). Van Dersal, Nat. Woody Pl. U. S. 115. 1938, in part. *C. nevadensis* Abrams is listed as a synonym.

FIGURE 25.

CUPRESSUS NEVADENSIS—Piute Cypress.

Oscar Meier's Ranch, 3 mi. southeast of Bodfish, Kern Co., Calif.

A—Coll. No. 6203 (Prop. No. 2159). Tree about 10 m. high. Photo Oct. 20, 1934. Neg. No. 3380.

B—Coll. No. 6204 (Prop. No. 2160). Trunk with furrowed fibrous bark; the white card is 10 cm. x 15 cm. Photo Oct. 20, 1934. Neg. No. 3386.

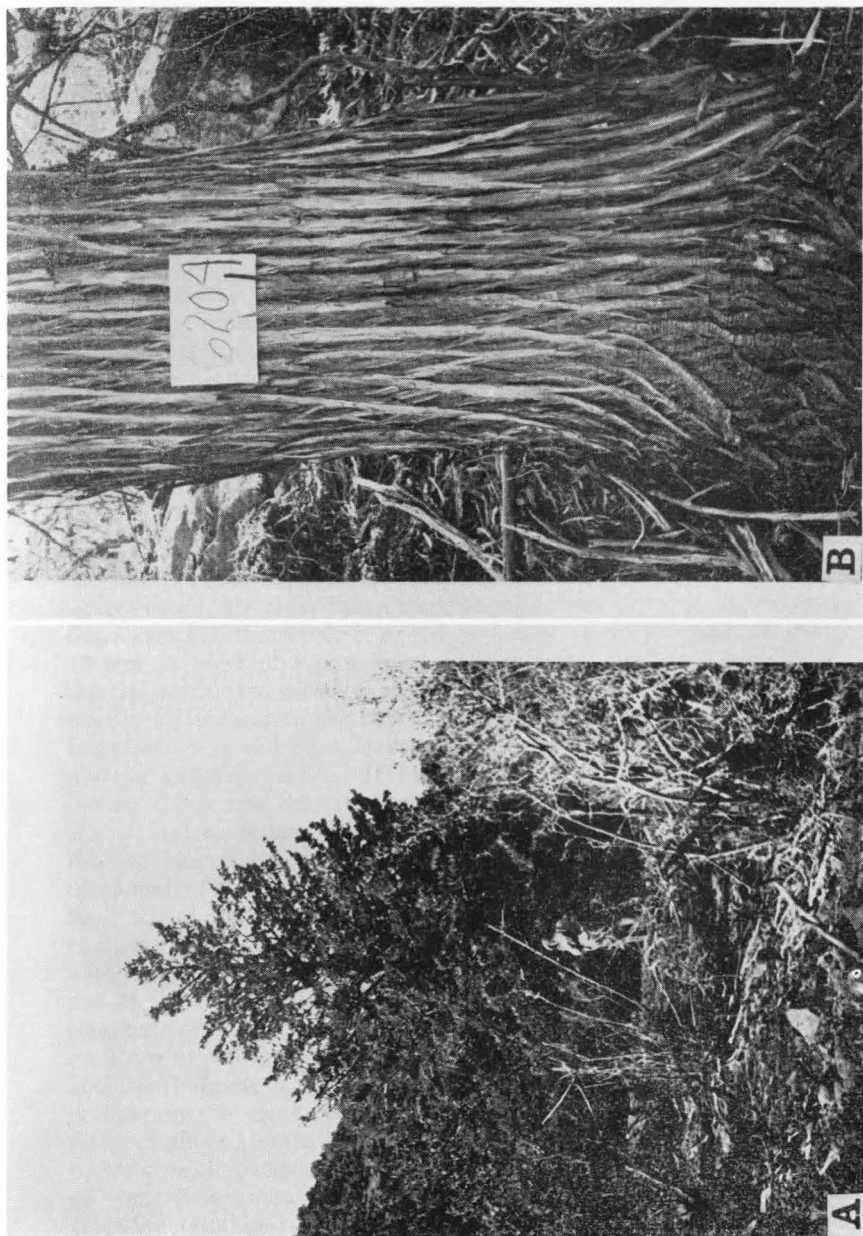


FIGURE 25. *Cupressus nevadensis*. For explanation see opposite page.

6. *Cupressus Stephensonii* — Cuyamaca Cypress

Cupressus STEPHENSONII C. B. Wolf species nova. An erect or somewhat spreading tree 10 to 16 m. in height, the broadest nearly 10 m. in spread, generally with a straight central leader and a trunk up to 7 dm. in diam., the bark of which is thin, cherry-red, smooth and exfoliating, not at all fibrous, but sometimes the older surfaces a bit grayish. In aspect, the trees are glaucous blue-gray or gray-green, although on new growth or after rains the foliage is definitely greener. When lightly crushed the foliage has a distinctive, somewhat lemon-like odor. Branchlets rather thick and stiff, the divisions occasionally unbranched for 15 to 20 mm., but usually less than 10 mm. in length, varying from 1.5 to 2 mm. in thickness, generally somewhat 4-sided. Leaves about 1 mm. long and wide, acutely pointed, rounded on the back and early developing an active dorsal pit, or on some branches these not visible until secondary branching has occurred, or, in some instances, the leaves do not have pits; the ciliate or fimbriate margins of the leaves are plainly visible under a low power lens. On less vigorous shoots the leaves are not so acutely pointed and are more closely imbricated. The resin or pitch from the dorsal gland is at first clear, but as it dries turns to gray or nearly white. On older branches, especially those growing vigorously, the leaves become much enlarged and may attain a length of over 10 mm., a width of 3 to 4 mm. and have a free tip 2 to 3 mm. long, the tip much more acute than the normal leaves, and the dorsal pit usually located just at the base of this free portion. On such vigorous branches these enlarged leaves usually turn brown within a few months and are pushed off by the expanding bark of the branch during the second season. Staminate cones 2 to 4 mm. long, about 2 mm. thick, rather cylindrical and only slightly thinner at tip than at base, the surfaces only slightly flattened (that is 4-sided), composed of 8 to 14 scales, but usually 10 or 12, each scale 1.5 to 2 mm. broad, broadly triangular at upper end and rounded at base, the pollen sacs 3 to 5, the basal and terminal scales usually with 3 and the central with 4 or 5. Ovulate cones produced at the tips of short stubby branchlets which are somewhat thicker than the staminate or vegetative branchlets and have their leaves well imbricated. Prior to pollination the cones are about 3 mm. high, equally broad, and the fimbriate margins of the scales are plainly visible. Following pollination the cones soon turn from green to brown and attain a diam. of about 10 mm. the first season. Cone scales 6 or 8, but mostly 6, these with conspicuous umbo 3 to 4 mm. high and conical or on some cones these very low and inconspicuous. At maturity the cones are a dull gray or brown, and the surface is somewhat roughened or warty, the largest cones about 25 mm. in diam. and nearly spherical. Seeds average from 100 to about 125 per cone, not at all glaucous,

are very dark brown, very large and are mostly flattened, are over 5 mm. long and broad, but many of the largest are about 8 mm. long and broad, the main body usually only about 3 mm. broad, the remaining portion a very broad and thin wing, on some seeds nearly 3 mm. broad on the sides but narrower at the base and apex; body of seed darker than wings, the hilum very light tan, about 2 to 3 mm. long, conspicuous. In germination the 3 or 4 cotyledons carry the seed coat above ground, then expand and stand at nearly right angles to the main axis. Cotyledons 10 to 13 mm. long, linear and only slightly flattened, the tip blunt. The next leaves are in whorls of 4, are similar to the cotyledons, but are shorter, flatter and have a minute spine at the tip. As the seedling grows the later juvenile leaves are shorter, and gradually by transitional stages the branchlets produce the mature type leaves, but some of the last transitional types have dorsal pits, even though slightly spreading and with spiny tips.

Arbor 10-16 m. alta erecta vel subpatens. Foliis glauco-caesis vel glauco-griseis, odore citri lemonis, ca. 1 mm. longis latisque, dorso rotundatis, fovea saepissime ornatis, margine sub lente ciliatis fimbriatisve, in ramulis adultioribus bene evolutis ad 10 mm. longis, 3-4 mm. latis, apice libero ad 2-3 mm. longo. Amentis staminatis 2-4 mm. longis, ca. 2 mm. crassis, subcylindricis, squamis 8-14 (pro more 10-12), thecis in squama quove 3-5. Strobilis ovulatis in anthesi ca. 3 mm. longis latisque, squamis (6-8) margine bene fimbriatis, primo anno ad 10 mm. magnis, maturis ad 25 mm. subsphaericis. Seminibus in strobilo quove 100-125 haud glaucis, atrobrunneis, 5-8 mm. longis. Coytledonibus 3-4, 10-13 mm. longis.*

Type Locality

The type collection was made on the upper limits of King Creek, a tributary to the South Fork of the San Diego River, Cuyamaca Mountains, San Diego County, California, at about 4000 ft. elevation on a dry ridge near the creek in a mixed stand of *Adenostoma fasciculatum obtusifolium* and scattered trees of *Pinus Coulteri* at the upper limits of the Upper Sonoran Life Zone or the lower limits of the Arid Transition Life Zone. The type specimen was collected by Carl B. Wolf, Coll. No. 9467, December 1, 1938, from a tree about 8 m. high, 10 m. in spread and a trunk 8 dm. in diam. at 1 m. above the ground, the cherry bark exfoliating cleanly leaving a smooth trunk, the foliage a glaucous, bluish-gray and the leaves largely with active dorsal pits.

This species is named in honor of the late Ranger Bert Stephenson, of the United States Forest Service, who for many years was District Ranger at Descanso, San Diego County, and who died in 1944.

*Latin description by Dr. Leon Croizat, Arnold Arboretum, Harvard University.

Several years ago Mr. Stephenson noted the cypress trees on King Creek while fighting a forest fire in the area. It is a pleasure to associate the name of Mr. Stephenson with this rare tree of the Cuyamaca Mountains, who for nearly a half century was in no small way responsible for this and other important portions of the Cleveland National Forest. His brother, Terry E. Stephenson, who died in 1943, was a member of the Garden's Advisory Board.

Range

United States. California. San Diego County. Cuyamaca Mountains, on the headwaters of King Creek, which rises on the southwest side of Cuyamaca Peak and flows into the South Fork of the San Diego River. There seems to be no true grove of *Cupressus Stephensonii* on the headwaters of King Creek; instead, the trees are scattered over a chaparral slope mainly of *Adenostoma fasciculatum* var. *obtusifolium*, through which are also scattered individuals of *Pinus Coulteri*. The main area on which the cypress trees grow appears to be slightly more than one mile in extent, with a few trees as low in elevation as 3000 ft., and the ones at the upper limits at about 4000 ft. elevation. The West Mesa Truck Trail leaves the Descanso road a few miles above Descanso, and at 2.4 miles up (north) the cypresses come down to the road. A mile or so nearer Descanso there is a lone tree in a small wash (C. B. Wolf, Coll. No. 6266), but the real stand begins as indicated above. A walk up the bed of King Creek for a distance of about 1.2 miles brings one to the finest trees, of which many are 15 or 16 m. high, have straight trunks often 6 or 8 dm. in diam. and well shaped crowns. The larger trees have beautiful, rich, cherry-red bark and blue-gray foliage. There is a comparatively small number of small or young trees in this area, which along with the large trees indicates that fires have not gotten into the cypress area and destroyed the old trees and caused reproduction in thickets as is commonly the case for some of the other species.

As far as can be determined, this is the only station for *Cupressus Stephensonii*, and unless additional stations are discovered it is, thus, one of the rarest of all species; the other California species of very limited number as to individual trees being *C. Abramsiana* and *C. nevadensis*.

Collections:

a). C. B. Wolf, Coll. No. 6266 (Prop. No. 2313, our King Creek No. 1 Strain), December 28, 1934, from a lone tree about 3000 ft. elevation, with a height of 6 m., a spread of 4 m. and a trunk 3 dm. in diam. b). C. B. Wolf, Coll. No. 9467 (Prop. No. 3370, our King Creek No. 2 Strain), Type collection. c). C. B. Wolf, Coll. No. 9468 (Prop. No. 3371, our King Creek No. 3 Strain), December 1, 1938, from along the West Mesa Truck Trail, 2.4 miles above the Descanso

7. CUPRESSUS GLABRA — Smooth Arizona Cypress*

Cupressus glabra Sudw., Am. For. 16: 88. pl. 1910. A dense to somewhat openly branched tree 7 to 15 m. (rarely to 20 m.) high, with a spread of 5 to 12 m. Branching near the ground and producing a crown of several subequal, erect branches, or retaining a straight, central leader. Trunk usually 4 to 6 dm. in diam. (rarely over 1 m.). Bark of main trunk variable as follows: 1). on all young saplings and most trees of mature size, the bark is smooth, cherry-red, exfoliating annually in thin layers or plates; these non-fibrous and often gray or silvery on their surface. 2). occasional trees develop a thin, only partially exfoliating bark somewhat like that of *Juniperus pachyphloea*, hence, somewhat "alligator-like". These curious-barked trees occur with those of the normal type. 3). very old, obviously over-mature or decadent trees frequently fail to exfoliate their bark, at least for several meters above ground. Almost without exception, the bark of the larger branches is smooth, cherry-red, with the surface of the exfoliating plates often a soft, silvery gray. Bark of small branches (under 2 cm. in diam.) usually dark gray or brownish, later turning cherry-red. Branchlets evenly disposed on all sides of the branches, either alternate or opposite, standing out strongly, those of the season often unbranched for 15 to 20 mm., 1 to 1.7 mm. thick (occasionally 2 mm.). Leaves 1.5 to 2 mm. long, acute, keeled or ridged on back; on nearly all leaves dorsal gland is well developed and visible even on very young leaves, although an occasional branchlet bears leaves on which gland is lacking. In most instances, glands are active and exude resin which turns dark or whitish as it dries. Margins of leaves fimbriate as seen under a low power lens (10.5x). On vigorous branches leaves enlarge and may become 12 mm. long, 3 to 4 mm. wide, and have a very acute spreading tip. These leaves are usually of short duration, soon turn brown and are pushed off by the expanding bark of the branch beneath. Foliage is either dusty gray-green, or particularly on young trees a definite gray, due to a glaucous bloom, as well as to the rather conspicuous whitish resin from the dorsal glands. Thus, generally speaking, the individuals of this species are usually much grayer than those of *C. arizonica*. Staminate cones borne on short branchlets usually less than 10 mm. long, are about 3 to 5 mm. long by 2 mm. in diam., taper a little to the tip, composed of 10 to 18 scales, each about 1.8 mm. broad, rounded at base, triangular at apex, margins a little fimbriate, pollen sacs 4 to 6, the central ones usually with 5 or 6 sacs. Ovulate cones produced at the ends of short, stubby branchlets, which are somewhat thicker than

*Sudworth proposed the name "Smooth Cypress" for this species, however, it is cultivated extensively in California and other mild sections under the name "Arizona Cypress". Therefore, in order to distinguish it from the genuine *C. arizonica*, I propose to use the name "Smooth Arizona Cypress" which will not upset horticultural nomenclature to any extent. This is also the recommended name for this cypress in Standardized Plant Names 148. 1942.

the staminate or vegetative ones and have their leaves well imbricated. Prior to pollination, the cones are about 3 mm. long, equally broad, and the scales have slightly fimbriate margins. Cone scales 5 to 10 (usually 8, but when an odd number apparently due to failure of one of the scales of the lower pair to develop). At maturity the largest cones are about 32 mm. long, usually a little less in width, but generally are 20 to 25 mm. in length. Seeds approximately 90 to 100 per cone, extremely variable in size and appearance, usually medium tan to brown, rarely very dark, from 3 to 8 mm. long (mostly 4 to 5 mm. long) and broad, main body smooth or slightly warty with minute pustules, and almost always faintly to heavily glaucous. Hilum conspicuous as a lighter scar, 1 to 3 mm. long, or inconspicuous because about same color as rest of seed.

Type Locality

"Found by the writer on the north slope of the Verde River Canyon in Yavapai County, Arizona. . . . The Verde Canyon forest is about six miles long and about one and one-half miles wide." Sudw., Am. For. 16: 88. 1910. The plate accompanying the original description was, apparently, made from fresh material and shows a branch with numerous mature cones. The glandular leaves can be clearly seen.

Five years later Sudworth in a paper entitled "The Cypress and Juniper Trees of the Rocky Mountains Region" (U. S. D. A. Bull. 207: 8. 1915), contributed the following additional information about this species. "It was not distinguished, however, until February, 1910, when it was named and described from a grove of trees discovered by Mr. Arthur H. Zachan on the north slope of a small tributary stream on the west side of the Verde River Canyon, about 16 miles southeast of the town of Camp Verde. This grove covers an area about six miles long by $1\frac{1}{2}$ miles wide. This grove is partly on a ranch belonging to William A. Tinsley, and is approximately in Township 11 North, Range 5 East, where Mr. Zachan saw it first in 1907, and called the writer's attention to the fact that the trees had a very different bark from that of the Arizona Cypress common in Chiricahua Mts."

Range

Cupressus glabra is confined to central Arizona from Oak Creek Canyon, Coconino County to the Mazatzal Mts., Gila County, a north and south distribution of about 80 miles. The major portion of the trees is found on the drainage system of the Verde River, and thorough exploration of all its ramifications would undoubtedly disclose a number of localities not now recorded for this species. No other species of *Cupressus* is known to occur within this area, and

it is fully a hundred miles from the southernmost station in the Mazatzal Mts. to the nearest stand of *C. arizonica* in the Santa Catalina Mts. Sudworth (U. S. D. A. Misc. Circ. 92: 37. 1927) lists *Cupressus glabra* from the Santa Catalina and Santa Rita Mts. of southern Arizona, but I regard all the trees in the former range to be *C. arizonica*. As to the cypress in the Santa Rita Mts., see discussion under *C. arizonica* for that locality.

Habitat

This species is confined to the Upper Sonoran Life Zone or the lower borders of the Arid Transition Life Zone. In general, most of the trees occur at elevations of from 4000 to 5000 ft. In many instances, they grow close to stream beds; but, in others, occupy steep hillsides, particularly those sloping to the northeast or northwest. They grow in a variety of soils from clay to gravel and slate. Rather pure stands of limited extent are common, but the trees are also associated with a mixture of species such as: *Arctostaphylos Pringlei*; *Fraxinus velutina*; *Juniperus pachyphloea*, *J. scopulorum* and *J. utahensis*; *Mahonia haematocarpa*; *Pinus edulis* and *P. ponderosa*; *Platanus Wrightii*; *Rhamnus crocea* subsp. *ilicifolia* and *Rhus ovata*.

Trees of this cypress growing in thickets are nothing more than canes with a few branches bearing a cluster or two of cones at their tips. On the other hand, where ample room is available and other conditions for growth are favorable, beautiful pyramidal specimen trees are frequent. The extremely glaucous form so commonly seen in cultivation seems to be present in every natural locality but is mainly a condition of young vigorous trees.

Localities—(All in Arizona)

1. Cypress Peak to Reno Pass, Mazatzal Mts., Gila and Maricopa Cos. This is the southernmost station known for *C. glabra* and is located in Township 6 North, Range 9 East, Gila and Salt River Meridian. This locality is, apparently, nothing more than an extension of the Mt. Ord stands of cypress just a few miles to the north and was pointed out to us on October 9, 1942 by the U. S. Forest Ranger at the Reno Ranger Station at Tonto Basin, at the east base of the Mazatzal Mts. The trees which were clearly visible on the high ridges were too far away to be determined as *Cupressus*, even with our telescope. The Ranger assured us, however, that they were similar to those on Mt. Ord with which he was familiar, since both areas were in his district. Because of the lack of roads to this area and our limited time, we did not visit them.

2. Mt. Ord, Mazatzal Mts., Gila and Maricopa Cos. The main

stands of cypresses noted by us in this region are in Township 7 North, Range 9 East, Gila and Salt River Meridian, but a few are to the east in Township 7 North, Range 10 East. The stands are easily accessible by road, and are reached by turning off the Roosevelt to Payson road about 5 miles north of the Reno Ranger Station in Tonto Basin. This side road to Mt. Ord is marked only by a sign to the Boaz Mine. A few stray cypresses grow in the canyon along the first part of this road, but it is not until one is within a mile or two east of the mine that rather large groves are noted on the northeast hillsides. There is another grove of cypresses in a large canyon about 1 mile north of the Boaz Mine. Just west of the main buildings of the mine, the road ascends Mt. Ord. Within a mile this road passes into almost pure stands of cypresses which clothe a large area of the north slope of the mountain. For the most part, the trees grow at elevations of 4000 to 4500 ft. in a loose, broken, gray slate. Associated with the cypresses are *Rhus ovata*, *Rhamnus crocea* subsp. *ilicifolia* and a shrubby species of *Quercus*. The cypress trees on the slopes of Mt. Ord are mainly less than 10 m. high, a great many have only a very short main axis which soon branches into several leaders forming a rounded crown. In some areas there are extensive thickets of small trees 3 to 4 m. high. A characteristic feature of the stands of cypress on Mt. Ord is the heavy production of cones, nearly every tree being heavily laden. The bark of the main trunk and branches exfoliates in thin flakes, leaving a polished, cherry-red or mahogany-brown surface. In many instances, the surface of the new and old bark is mottled with a silvery or gray bloom. Nothing is known to me as to the fire history of Mt. Ord, but the large patches of more or less evenly sized trees with occasional clumps of individuals of much larger size indicate that past fires have been responsible for reseedling the stand so thickly, and that a few trees escaped some of the fires.

Collections:

a). C. B. Wolf and P. C. Everett, Coll. No. 11417, October 9, 1942, from 9/10 mi. above Boaz Mine. Tree 10 m. high, 6.6 m. spread, and a trunk 3 dm. in diam. This is a beautiful specimen in the bottom of a ravine. The main axis is straight, and the branches are ascending of which the largest are about 1.5 dm. in diam. This tree closely resembles a typical specimen of *C. Stephensonii*, except that its leaves are considerably more glandular. b). C. B. Wolf and P. C. Everett, Coll. No. 11418 (Series A to W), October 9, 1942, from same area as Coll. No. 11417. This collection represents 23 sheets, each taken from a different tree to show the variation in cone size and other morphological features. Many of the trees from which these are taken are less than 2 m. in height but are well laden with cones. The cone size is extremely variable, even on a single tree, indicating that seasonal growth variation is an important point to

consider. Of this series of specimens, Coll. No. 11418-M is of interest because its leaf glands are as inconspicuous and inactive as practically any specimen of *C. arizonica*. c). C. B. Wolf and P. C. Everett, Coll. No. 11419, October 9, 1942, from 2 2/10 mi. above the Boaz Mine, on a steep, north hillside, at about 4500 ft. elevation. Tree 6 to 7 m. high, of equal spread, with a main trunk 4 dm. in diam., but this soon branching into numerous ascending leaders, forming a rounded crown very like that of a typical tree of *C. Forbesii*. On the slopes of Mt. Ord this form, lacking a central leader and producing a rounded crown, is more abundant than elsewhere for this species. In addition to the abundant unopened cones on this tree, it also has thousands of old blackened cones which opened years ago, but have remained on the branches and are gradually weathering away. d). C. B. Wolf and P. C. Everett, Coll. No. 11420, October 9, 1942, with Coll. No. 11419. Tree 4 m. high, 1.3 m. spread and a trunk about 1 dm. in diam. at ground level. This tree well laden with staminate cones and growing in a dense thicket of similar-sized individuals. The main trunk cut off at 15 cm. above the ground is 8.5 cm. in diam. and has approximately 70 annual rings, of which 37 to 40 appear as darker heartwood. This slow growth rate is approximately that noted for *C. arizonica* at Clifton and Bonita Canyon under somewhat similar conditions.

3. Cypress Thicket, Rye Creek, Mazatzal Mts., Gila County. This is an extensive area of cypress largely located on the headwaters of Rye Creek and lying slightly northeast of North Peak in the Mazatzal Mts. It is easily accessible by road. At the Rye Creek Store, located about 15 miles south of Payson on the road to Roosevelt Dam, a side road leads off to the northwest following up Rye Creek. This area of cypresses is, perhaps, the largest single stand of *C. glabra* and covers many square miles. A large part of the trees is in Township 10 North, Range 9 East, Gila and Salt River Meridian, but there are also some trees in Township 9 North, Range 9 East. The first trees on Rye Creek are confined to the immediate creek bed and occur about 3 miles above the Rye Creek Store. As the road ascends Rye Creek, the cypresses become more numerous and spread out over the adjacent rolling ridges. The flat divide which separates the Rye Creek drainage system from that of the East Verde River is about 8 miles by road from the Rye Creek Store. At this point, the almost pure stands of cypress can be seen to extend for several miles to the north, possibly to the East Verde River. Most of the cypresses in this area occur at an average elevation of about 4000 ft. Associated with them are Piñons, Scrub Oaks and Manzanita, all growing in a basic soil of reddish or yellowish clay containing considerable rocks and gravel. The average cypress tree is less than 10 m. in height, but a few are over 13 m. high. However, many of the finest specimens have broad, pyramidal crowns with a spread nearly equal to the height,

and main trunks over 6 dm. in diam. Most of the trees are dusty-green in aspect, but some of the smaller and more vigorous individuals are bluish-gray. It is probable that this stand of cypresses is actually continuous with the East Verde River and Natural Bridge localities described below.

The principal use to which the cypresses on Rye Creek have been put has been for fence posts. At the Pine Ranger Station we learned on October 10, 1942, that ranchers were permitted to cut posts for their own use for a nominal charge of 7/10 cents per post; but, if cut for sale, they were charged 5 cents per post. Along the road in the Cypress Thicket, we saw many spots where posts had been cut. For the most part, these were lower branches from the large trees and would provide posts of the right size without being split. We were also told that considerable difference of opinion existed in the region as to the lasting qualities of cypress fence posts. Some ranchers, apparently, have had them last for many years, while others have had posts rot within a few years. My conclusion was that posts made from wood that had grown slowly were the ones that would last, since they had very little sapwood and were very dense. For this reason, lower branches appear to be exceptionally appropriate.

From Mrs. Rose Collom, who is a well-known student of Arizona plants, and who lives on a fork of Rye Creek, we learned that for many years she has gathered large quantities of the cones on Rye Creek, has extracted the seeds, and sold them to seed dealers in many parts of the world. Since her operations have been extensive and have been carried on for many years, it is likely that the major portion of the trees cultivated under the name of Arizona Cypress has come from this grove. At the time of our visit, she had a large quantity of recently gathered cones on hand, from which she was extracting the seeds.

Collections:

a). C. B. Wolf and P. C. Everett, Coll. No. 11421, October 10, 1942. This is a columnar tree 10 m. high, 2 m. in spread, and with a trunk 3.5 dm. in diam. at the ground, then forking into 3 strictly erect branches. There are a few cones in the very top of this tree, but they cannot be readily obtained. According to Mrs. Collom, several attempts have been made to propagate this rare form from cuttings but none has yet succeeded. We took cuttings, carefully packed them in our ice-box, and upon our return to California on October 14, 1942, we gave them to Mr. Herbert Swim of Armstrong Nurseries, Ontario, California, where they have been successfully grafted to rootstocks of the ordinary cultivated form of *C. glabra*. b). C. B. Wolf and P. C. Everett, Coll. No. 11422, October 10, 1942. Tree 13 m. high, 10 m. in spread, and with a trunk 6 dm. in diam. This is a broad-crowned tree with many branches 1.5 to 2 dm. in diam., and a rather weak, upper central leader. Close to the ground the bark of the main trunk

is a little gray and does not exfoliate cleanly. Higher up the bark is cherry-red and exfoliates in thin non-fibrous plates, as do the branches. c). C. B. Wolf and P. C. Everett, Coll. No. 11423 (Series A to Q), October 10, 1942. This collection consists of a number of specimens, each taken from a different tree to show the variability of the cones and foliage. d). C. B. Wolf and P. C. Everett, Coll. No. 11424, October 10, 1942. Tree 13 m. high, 11.5 m. in spread, and with a trunk 6 dm. in diam. Foliage medium gray. Bark of main trunk is not exfoliating completely. Perhaps, this is an over-mature tree, not growing vigorously enough to cause the old layers of bark to be pushed off. e). C. B. Wolf and P. C. Everett, Coll. No. 11425, October 10, 1942. This is a bark specimen only, taken from about 3 dm. above the ground from a tree 10 m. high, 6.5 m. in spread and with a trunk 4 dm. in diam.

4. East Verde River, Gila Co., Arizona. The road from Payson to Pine crosses the East Verde River about 6 miles north of Payson, at which point are scattered cypresses along the river. However, they do not appear to grow on the adjacent hillsides in this area. On our visit to this locality, we were unable to spare time to follow down the East Verde River for more than a short distance, but I suspect that cypresses are more or less continuous along the river to the fringes of the stands mentioned on Rye Creek. Sycamore Creek, a tributary of the East Verde River, joins it at this point, and for approximately 4 miles up its canyon, cypresses grow in an almost continuous belt. Associated with the cypress on the East Verde River and Sycamore Creek are: *Platanus Wrightii*, *Fraxinus velutina*, *Juniperus pachyphloea* and *Alnus* sp.

Collection:

C. B. Wolf and P. C. Everett, Coll. No. 11426, October 10, 1942, from the East Verde River, 6 2/10 mi. north of Payson, 4500 ft. Tree 14 m. high, 10 m. in spread, and with a trunk 1.6 m. in diam. at ground and 1.3 m. at 1 m. above ground. This specimen is a magnificent old giant, apparently over-mature, and is no longer making any vigorous growth. The rather rough bark of the main trunk is gray, does not exfoliate, is over 5 cm. thick, but is not really fibrous, and consists of innumerable layers or plates of bark which are rather easily pulled off and separated. A casual examination of this specimen would suggest that it is *C. arizonica*.

5. Natural Bridge, Gila Co. This area is located about 5 miles south of Pine on the road to Payson, at which point a road leads in to Natural Bridge. J. W. Toumey reported cypress in this area in 1895 (Garden and Forest 8: 32), which probably establishes this area as the first known station for this species. We visited this area on October 10, 1942 and found cypress trees well scattered along the road in to Natural Bridge. In this rocky, rolling, mesa-like country,

the principal cover consists of an open growth of *Juniperus pachyphloea* and *J. scopulorum*, while the cypresses make up only a very minor part of the total woody plants.

Collection:

C. B. Wolf and P. C. Everett, Coll. No. 11427, October 10, 1942, $\frac{1}{2}$ mile west of Pine to Payson road, on road to Natural Bridge, 4500 ft. elevation. Tree 11.5 m. high, 6.5 m. in spread, and with a trunk 4 dm. in diam. This is a beautiful, pyramidal specimen with dusty-green foliage, a smooth, cherry-red or mahogany-brown bark, and numerous ovulate cones. Several clumps of mistletoe (*Phoradendron* sp.) grow in the tops of this and several other adjacent cypresses.

6. Pine, Gila County. The area around the little community of Pine, as the name suggests, is a pine forest made up of Yellow Pines (*Pinus ponderosa*) and a few Alligator-Barked Junipers (*Juniperus pachyphloea*). Two areas in the vicinity of Pine were noted on October 10, 1942 as containing cypresses. The first of these is on a rather rocky hillside about 3 miles south of Pine on which there is an almost pure stand of cypresses (probably mostly in Section 4, Township 11 $\frac{1}{2}$ North, Range 9 East, Gila and Salt River Meridian). The second is 1 $\frac{4}{10}$ miles northwest of the Pine Ranger Station on the road to Camp Verde. At this locality the cypresses are rather limited and do not form a grove. Most of the trees appear to be typical, with exfoliating bark on the main trunk. However, the following collection is of interest in that it represents a form that appears sporadically in this species in other places as well as in *C. arizonica*.

Collection:

C. B. Wolf and P. C. Everett, Coll. No. 11428, October 10, 1942, 1 $\frac{4}{10}$ mi. northwest of the Pine Ranger Station. Tree 14 to 15 m. high, 11 to 12 m. spread, and a trunk 5 dm. in diam. at the ground. The bark of the trunk is somewhat checkered, or "alligator-barked". The new ovulate cones now approaching maturity are covered with a heavy bloom and are, thus, nearly white or at least very light gray.

7. Oak Creek and Sedona area, Yavapai and Coconino Counties. The Sedona area of cypresses comprises several large stands which are more or less continuous. Most of the trees grow on the drainage system of Oak Creek, but a few are on Dry Beaver Creek. The southernmost are on the latter creek about 10 miles south of Sedona on the Rimrock Road. These consist of scattered trees confined to the creek bed, where they are associated with *Platanus Wrightii*, *Juniperus utahensis* and *Mahonia haematocarpa*, at an elevation of about 4500 ft. In the canyon to the north of Bell Rock, or approximately 4 $\frac{6}{10}$ mi. south of Sedona, there is an extensive forest of cypresses extending on both sides of the road. From this point north to Sedona, they are practically continuous and are more or less abundant along

Oak Creek for several miles to the north of Sedona where they end abruptly at an elevation of about 5000 ft. at Indian Head Rock. Within the actual gorge of Oak Creek are numerous river benches on which there are fine stands of cypresses. One of the finest of these is on the east side of the creek opposite Indian Head Rock. Many of the trees in this colony are nearly 20 m. high and grow closely together, with their trunks without branches for 6 to 7 m., tapering only slightly from bases 5 to 6 dm. in diam., and retaining their smooth cherry-red, exfoliating bark character. At the upper limits of cypress in Oak Creek Canyon, the associated trees are *Pinus ponderosa* and *Alnus* sp.

The Oak Creek and Sedona cypress area, described above, extends not much over 16 miles north and south and, as far as we could determine, is not over 1 or 2 miles in width at any point. These observations were verified by a discussion with the U. S. Forest Ranger at the Sedona Ranger Station on October 11, 1942. This same ranger told us that he had had reports of similar cypresses in the Sycamore Canyon wilderness area which lies some 15 to 20 miles northwest of Sedona. The area is not accessible by car, and because of limited time we were unable to verify this report.

Anyone who would like to study *C. glabra* in the field, and who could visit but one Arizona locality, would do well to visit the Oak Creek and Sedona region. In addition to the splendid stands of cypresses, there are many other attractive features. The road from Flagstaff to Oak Creek Canyon is an excellent paved highway, and Oak Creek Canyon and the region immediately south of Sedona are filled with scenic features, largely made up of huge, red sandstone formations which alone are worth a great deal to see. The most notable of these are Munds Mountain, Bell Rock, Cathedral Rock, and Courthouse Butte.

Collections:

a). C. B. Wolf and P. C. Everett, Coll. No. 11429, October 11, 1942. Along Dry Beaver Creek about 10 miles south of Sedona, Yavapai Co., 4500 ft., growing in rocky, red, sandy clay. Tree 13 m. high, 10 m. in spread, branching at ground into 3 trunks of 4, 4.5 and 6 dm. in diam. Bark not completely exfoliating, but the plates thin, curling, non-fibrous, and exposing a smooth, rich, cherry-red, or mahogany-brown surface beneath. Aspect of the foliage is a dusty-green. The cones are very abundant and covered with a heavy, white or gray bloom. b). C. B. Wolf and P. C. Everett, Coll. No. 11430, with Coll. No. 11429. Tree 6 m. high, 6 m. in spread, and with a trunk 22 cm. in diam. This is a shapely small tree with a straight central axis, rich, dark red, smooth bark, rich gray-green foliage and numerous unopened cones several years of age. c). C. B. Wolf and P. C. Everett, Coll. No. 11431, October 11, 1942, from

4 6/10 miles south of Sedona in the canyon to the north of Bell Rock, at about 4500 ft. elevation, Coconino Co. Tree 15 m. high, 6 m. in spread, and with a trunk 5 dm. in diam. Bark of trunk gray on surface, not exfoliating cleanly, but the under layers dark red. This tree gray-green in aspect, but some of the small ones nearby are blue-green. Numerous seedlings are in this area. d). C. B. Wolf and P. C. Everett. Coll. No. 11432 (Series A to G), October 11, 1942, Oak Creek Canyon, about 1 mi. north of Wilson Bridge, Coconino Co. These specimens are each from a different tree from a clump of small trees mainly 3 to 7 m. tall. They grow in a rocky ravine, and practically all the trees are a dusty-green in aspect. e). C. B. Wolf and P. C. Everett, Coll. No. 11433, October 11, 1942, Oak Creek Canyon, north of Sedona at Indian Head Rock, Coconino Co., at about 5000 ft. elevation. Tree 13 m. high, 6 to 7 m. in spread, and with a trunk about 5 dm. in diam. This is a beautiful specimen located close to the road and with plenty of light for maximum foliage development. The foliage is blue-green, but the numerous staminate cones give the tree a slightly yellowish cast at this time. The non-fibrous red bark does not exfoliate cleanly on this specimen.

Collections of Cultivated Specimens

a). C. B. Wolf, Coll. No. 7689, December 11, 1935, from a cultivated tree 8 m. high, 7 m. in spread and with a trunk about 8 dm. in diam., south of Newhall, Los Angeles County, California, at 1300 ft. elevation. Bark of trunk exfoliating, leaving a smooth red-brown surface, most leaf glands active, well laden with staminate cones, foliage blue-green, glaucous. This is one of the oldest plantings of *C. glabra* in California and extends along the highway from south of Newhall to Saugus, a distance of several miles. According to Theodore Payne, the plants were grown by him probably from seeds from Mrs. Collom on Rye Creek, Mazatzal Mountains, Arizona. b). C. B. Wolf, Coll. No. 7690, December 11, 1935, from a cultivated tree 7 m. high, 3 m. in spread and with a trunk 4.5 dm. in diam. From same spot as No. 7689 above. Some of the dorsal glands appear to be inactive. Ovulate cones about 15-20 mm. long, mostly with 6 scales, very glaucous within, the seeds only lightly glaucous. c). Jesse C. Watt, November, 1939 (R. S. A.), from a cultivated plant at Armstrong Nurseries, Ontario, California. This specimen is an abnormal flat-foliaged (thuja-like) form appearing among normal seedlings. This plant probably grown from seeds supplied by Mrs. Collom (see C. B. Wolf, Coll. No. 7689, above). d). Thornton T. Munger, No. 3A, December, 1939, (R. S. A.), from a tree cultivated at the Wind River Experiment Station, Skamania County, Washington. Origin unknown. Leaves with active dorsal pits; seeds glaucous.

Relationships

The true status of *C. glabra* has been confused because it has so frequently been submerged in *C. arizonica* and has not been given careful consideration along with the other species of this group such as: *C. nevadensis*, *C. montana* and *C. Stephensonii*. *C. glabra* differs from *C. arizonica* mainly in having exfoliating red bark on the main trunk throughout its life, in its more glandular foliage, and larger cones with usually glaucous seeds. *C. Stephensonii* has similar bark but has inactive glands on the leaves. *C. montana* has active leaf-glands but a rough bark as in *C. arizonica*.

References

CUPRESSUS GLABRA Sudw., Am. For. 16: 88. pl. 1910. Original description of species, see quotation under Type Locality in text. 2). Sudw., U. S. D. A. Bull. 207: 8. 1915. In this paper Sudworth proposes the English name "Smooth Cypress" and states that the first published reference to this species was by J. W. Toumey (Garden & Forest 8: 32.) in 1895, in which he referred to a grove on Pine Creek at Natural Bridge. 3). Sudw., U. S. D. A. Misc. Circ. 92: 37. 1927, in part. Sudworth's distributional data are correct for this species except for the Santa Catalina and Santa Rita Mts., Arizona, of which the plants found in the first range are *C. arizonica*, and the second probably so, although I have been unable to verify the occurrence of any species of *Cupressus* in that range. 4). Van Dersal, Native Woody Pl. U. S. 114. 1938. 5). Kearney & Peebles, U.S.D.A. Misc. Pub. 423: 67. 1942. These authors have correctly distinguished between this species and *C. arizonica*, but are probably in error in relying on Sudworth's data in citing the Santa Catalina and Santa Rita Mts. as having this species.

CUPRESSUS ARIZONICA Sarg., Silva No. Am. 11: 105. 1896, in part, as to his reference to the Pine and Natural Bridge localities. 2). Elwes & Henry, Trees of Great Brit. & Irel. 5: 1183. 1910, in part, as to the distribution for central Arizona. 3). Dalli. & Jacks., Handb. of Conif. 193. 1923, in part. These authors suggest that most of the cultivated trees in England belong to *C. glabra*. 4). Little, Am. Journ. Bot. 31: 592. 1944. *C. glabra* Sudw. is listed as a synonym of *C. arizonica*. He states: "*Cupressus glabra* Sudw. should be reduced to synonymy, as it is separated from *Cupressus arizonica* Greene only on the basis of bark characters and different range in Arizona." Since my own conclusions as to the disposition of these two species are exactly opposite those of Little, it might be well to point out that they were arrived at only after giving full consideration to the related species, *C. nevadensis*, *C. Stephensonii* and *C. montana* which probably are as important to understand as the original *C. arizonica* and *C. glabra* in making taxonomic disposition.

CUPRESSUS ARIZONICA var. BONITA Rehd., in Bailey, Cult. Evergr. 210. 1925. Rehder has made the common mistake of assuming that *C. arizonica* var. *bonita* Lemm. and *C. glabra* Sudw. are synonymous. He states that this variety was introduced into Europe in 1882 as *C. arizonica*. He also mentions the var. *glauca* Wood., an horticultural juvenile form with very glaucous foliage. 2). Sarg., Man. Trees No. Am. 74. ed. 2. 1926, in part. Sargent correctly characterized *C. glabra* under the name *C. arizonica* var. *bonita* which is a misapplication of the name, although he lists the former as a synonym. His distribution is correct for *C. glabra* with the exception of the citation of the Santa Catalina and Santa Rita Mts. 3). Tidest. & Kittle, Fl. of Arizona & New Mex. 5. 1941. The authors of this flora have made the common mistake of assuming that *C. arizonica* var. *bonita* Lemm. and *C. glabra* Sudw. are synonymous.

CUPRESSUS ARIZONICA var. GLAUCA Rehd., in Bailey, Cult. Evergr. 210. 1925. This is listed as a synonym of *C. arizonica* var. *bonita* and is credited to Woodall.

FIGURE 27.

CUPRESSUS GLABRA—Smooth Arizona Cypress.
Hillside with practically pure stand of Smooth Arizona Cypresses, on north slope of Mt. Ord, Mazatzal Mts., above the Boaz Quicksilver Mine, Gila Co., Arizona. Made from a Kodachrome (No. 307), taken Oct. 9, 1942.

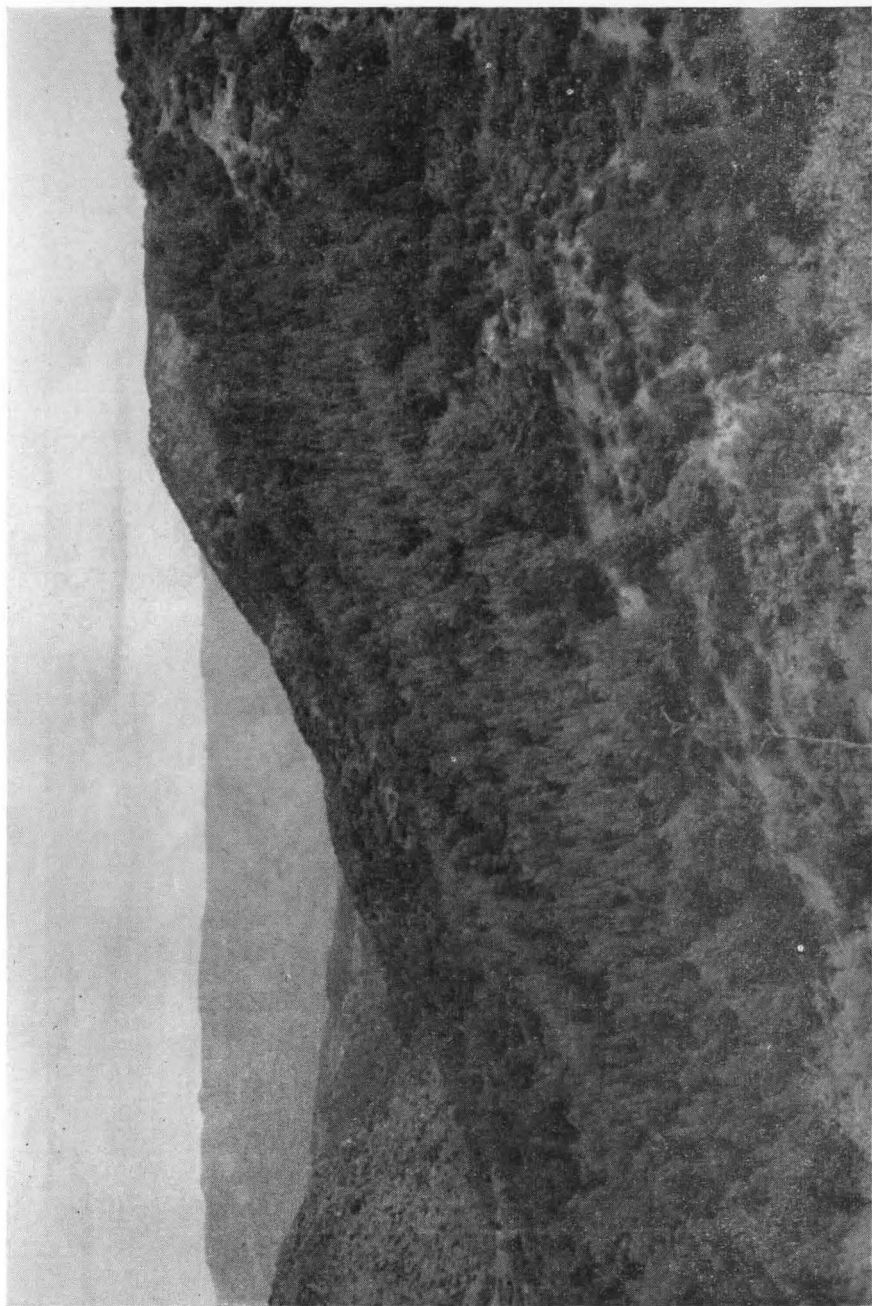


FIGURE 27. *Cupressus glabra*. See opposite page.

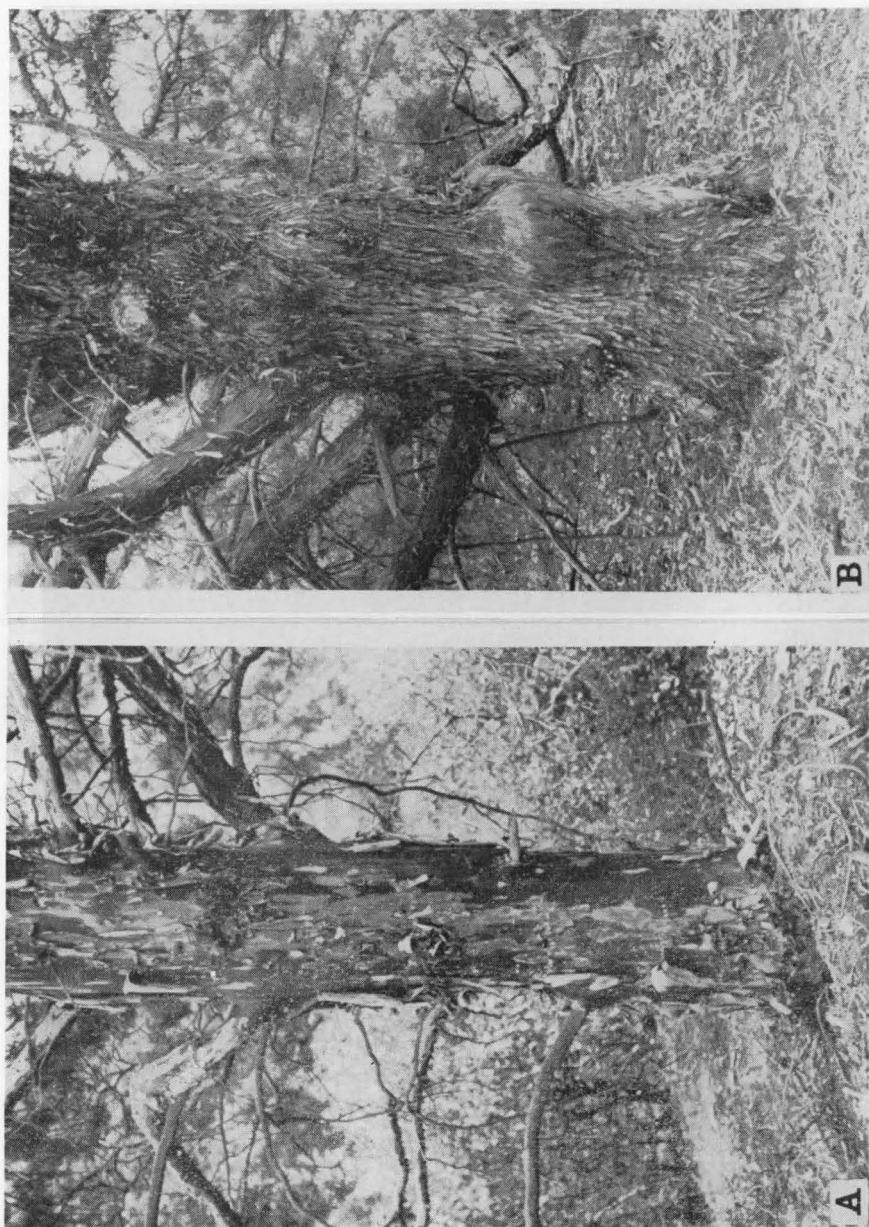


FIGURE 28. *Cupressus glabra*. See opposite page.

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FIGURE 28.

CUPRESSUS GLABRA—Smooth Arizona Cypress.

A—On the slopes of Mt. Ord, Mazatzal Mts., 9/10 mi. above the Boaz Quicksilver Mine, Gila Co., Arizona. *Coll. No. 11417*, the trunk about 3 dm. in diam. at 1 m. with exfoliating, non-fibrous bark, leaving a rich red surface. Made from a Kodachrome (No. 309), taken Oct. 9, 1942.

B—In the "Cypress Thicket" on Rye Creek, Mazatzal Mts., Gila Co., Arizona. *Coll. No. 11422*, showing trunk about 6 dm. in diam. with non-fibrous bark which does not exfoliate cleanly, although loose. Made from a Kodachrome (No. 315), taken Oct. 10, 1942.

8. CUPRESSUS LUSITANICA — Mexican Cypress*

Cupressus lusitanica Mill., Gard. Dict. ed. 8. n. 3. 1768. Tree with flexible and drooping branches (at least when young), these soft to the touch; not at all harsh as in some species. Foliage in aspect green to bluish-green. The branchlets of the season often 15 mm. long, mainly about 1 mm. thick, but sometimes 1.5 mm. thick. Leaves on young branchlets well imbricated, their tips closely appressed to the stem, forming distinctly 4-sided branchlets. Young leaves acute, about 1 mm. long, equally wide, the back rounded or only slightly ridged, the margins not visibly fimbriate under a lens (10.5x). In age, on vigorous branchlets the leaves enlarge and have coarse spreading tips 3 to 4 mm. long, the total length may be as much as 10 mm., the width up to 4 mm.; in age these leaves turn brown and are pushed off by the expanding branch beneath. Only an occasional leaf has a faint dorsal pit, these apparently never active. Foliage when crushed is almost without an odor, but such as it is has a faint resemblance to fish oil. Staminate cones produced on short branchlets 2 to 5 mm. long; the cones about 4 mm. long, 2.5 to 3 mm. thick, quadrangular, slightly broader at the base than at the blunt tip, mostly composed of 14 scales, but some with 18 or 20 scales, these about 2 to 2.5 mm. across and bearing usually 4 pollen sacs (none with 5 seen). Ovulate cones produced on cultivated trees as young as 5 years from seed. The very young cones are only slightly larger in diam. than the 4 or 5 mm. long branchlet upon which they are borne. During the first season, the cones are conspicuously white-glaucous (about like the berries of *Juniperus californica* at a similar age), attain a length of slightly less than 10 mm., are slightly less in thickness and have umbos 2 to 4 mm. high which are conspicuous, the umbos on the lower scales are spreading or even deflexed, the others erect and the 2 upper are rather slender conical and pointed. Scales of the cone 6 or 8 or even 10 (mostly 8), with the 2 lower scales frequently very small. During the second season, the cones gradually lose their white-glaucous surface and become a dull brown, attain a mature size of about 15 mm. in length but are slightly less in thickness; the umbos are still conspicuous but not nearly so much so as during the first year. Seeds about 75 to a cone, these 3 to 4 mm. long, somewhat less in width, usually thin, rich light tan, not at all warty-surfaced, the hilum lighter but inconspicuous, about 1 mm. long, the wing almost absent or on some seeds nearly 1 mm. wide. The cones, apparently, open the same fall that they mature and do not remain on the branchlet long thereafter. Seedlings with 4 cotyledons, these 8 to 10 mm. long, linear, blunt-pointed, mainly nearly terete. The next leaves are

*This species has long been called the Portuguese Cypress. It was also called Cedar of Goa. Both of these names were applied before it was generally concluded that the plant was Mexican in origin and they should be discarded.

in whorls of 4, are much shorter than the cotyledons, are flatter and have a spiny tip. About the second year, the branches gradually produce transitional types of leaves which are soon followed by the mature type.

Type Locality

Although Miller named this plant *Cupressus lusitanica*, it was his belief that it had originally been introduced to Portugal from Goa, India. This erroneous conception of its native habitat persisted for many years, and it is only fairly recently that botanists have accepted the idea that it was early introduced into Portugal from Mexico.

Range

Cupressus lusitanica, as here described, is based on material from the Federal District, Mexico. However, as pointed out below, in a broad sense the species ranges from central Mexico to Guatemala and Costa Rica.

Discussion

Almost since the inception of the present studies of *Cupressus*, I have been greatly concerned as to how to treat the much confused cypresses of Mexico, Guatemala and Costa Rica which have been known variously as the Portuguese Cypress, Cedar of Goa, Mexican Cypress, Bentham's Cypress, Knight's Cypress and under several other appellations, not to mention the numerous, supposedly different, species and varieties that have been formally described. As the references at the end of this species show, it is not only the most involved as to synonymy, but is apparently an extremely variable aggregation of forms which may represent several closely related species, a single species consisting of several subspecies, or a species with numerous minor variations, which, although of horticultural interest, may not be worthy of formal botanical recognition.

Detailed field studies of this group of forms or species as they occur in Mexico, Guatemala and Costa Rica are highly essential for a proper understanding of them. Unfortunately, I have not been able to do this, as has been possible for the species of the United States. The herbarium materials available to me in California herbaria, although fairly numerous, are an inadequate substitute for such intimate field observations. As a result, I have concluded that it would be highly hazardous to attempt to segregate a number of distinct forms under separate specific names, as subspecies under *C. lusitanica*, or on any other nomenclatorial basis.

The present treatment, therefore, consists of a description of cultivated plants grown in our tests from seeds unquestionably obtained from a native tree in Mexico. These have been demonstrated

to be very similar to material grown in England, regarded as *C. lusitanica*, and which was said to have been obtained in Portugal. On this basis, I have concluded, as have many others, that *C. lusitanica* is properly regarded as having originated in Mexico.

For the time being, it has seemed desirable to include all of the cypresses of Mexico, Guatemala and Costa Rica under *C. lusitanica*, with the exception of material which is referable to *C. arizonica*, *C. Forbesii*, *C. montana* and *C. guadalupensis*, species whose geographic distribution and botanical characters make them easily separable. However, in view of the tremendous number of names which have been published for the *C. lusitanica* group, their wide geographic distribution and their apparent variability, I have little doubt that adequate studies will eventually necessitate the recognition of several entities, perhaps only as subspecies.

Botanical Studies

In 1934 we received seeds of a cypress under the name of *C. thurifera* through Dr. W. W. Wagener, to whom, in turn, they had been supplied by the Sociedad Forestal Mexicana C. L., through the courtesy of its Secretary, Ing. Gilberto A. Along with the seed, Dr. Wagener was provided with a photograph of the tree from which it was collected and with the collection data. These were given our *Prop. No.* 2356. The following data were supplied by Dr. Wagener: "According to photo, parent tree appears to be about 50 feet tall. Elevation 2350 m. Cañada del Batán, Delegación, Cuajimalpa, D. F., Mexico. Collector M. Nava." From these seeds we propagated a number of plants, some of which have been fruiting regularly for several years.

Lambert's Genus *Pinus* 2. 1832, has an excellent colored plate (Tab. 65) labelled "*Cupressus lusitanica*" of which he says (p. 122): "The branch represented in Plate 65, was from a tree growing in my observatory, where it produced some hundreds of cones when not more than twelve feet high, the air of Wiltshire being much too cold for it unless protected in winter." It is of further interest to note, that in 1832, when this was written, no true cypresses had yet been described from the New World, unless *C. thurifera* H. B. K. (1817) is given recognition (for a discussion of this species, see Excluded Species). Careful comparison of Lambert's plate of *C. lusitanica* and our living material from Mexico, grown under our *Prop. No.* 2356, has convinced me that the two are conspecific, and that the *C. lusitanica* of Europe of those days must have come originally from Mexico.

In the fall of 1935, Mr. Eric Walther, of Golden Gate Park, San Francisco, California visited Mexico on a plant-hunting expedition, at which time he made several observations on Mexican cypresses for me. These were based on plants which grew in the region around

Mexico City. As a matter of convenience, he called them *C. Benthamii*. The herbarium specimen which he sent is now deposited in Rancho Santa Ana Botanic Garden Herbarium. On it are several cones, obviously in their second year, but not mature and still a little glaucous. His photographs of the tree from which it came show somewhat pendulous branches and a rough-barked trunk. Another photograph shows a fully mature tree (possibly planted) with a height of 25 to 27 m., a spread of about 12 to 13 m., and a clean trunk for 10 to 12 m., of which the average diam. is about 1.5 m. Another shows trees in an abandoned Carmelite Monastery, which were probably planted about 100 years ago, and which are over 20 m. high, have straight central leaders and trunks about 1 m. in diam.

I have discussed these Mexican cypresses with Mr. Walther, who is convinced that they constitute an extremely variable group but should all be referred to *C. lusitanica*. He bases his conclusions, not only upon his observations on several trips to Mexico, but also upon his long-time familiarity with various cultivated specimens in California, many of which he has personally grown.

In order to avoid confusion, I cite only the following collection as typical of what I regard as *C. lusitanica* Mill. In this way, any significant variations from it can be recognized by other workers, and less confusion will result, than if a number of variable forms is listed, based on the other herbarium specimens I have seen.

Collection:

C. B. Wolf, Coll. No. 11292, August 11, 1942, collected from a cultivated tree in the Rancho Santa Ana Cypress Test Plot; grown from seed under Prop. No. 2356 (see above for details as to source). This tree was 6 years old, over 7 m. high, 4 to 4.5 m. spread, had a trunk 1.5 dm. in diam.; its foliage was bluish-green, branches pendulous; brown cones apparently open soon after maturity, but those of the first season white-glaucous, like juniper berries.

Relationships

Cupressus lusitanica does not appear to be closely related to any of the other North American species of the genus, but on the basis of its practically non-glandular foliage, I regard it as much closer to the group which includes *C. macrocarpa* than to the *C. arizonica* group. No other North American species has such gracefully pendulous branching, but there is reason to believe that this feature may not be entirely constant for all the forms of *C. lusitanica*.

References

CUPRESSUS LUSITANICA Mill., Gard. Dict. ed. 8 n. 3, 1768.
"Cupressus (*Lusitanica*) foliis imbricatis, apicibus aculeatis, ramis dependentibus. Cypress with imbricated leaves terminating in spines.

and branches hanging downward." This description of the species is followed by "*Cupressus lusitanica patula. fructu minore. Inst. R. H. 587. Portugal spreading Cypress with a smaller fruit.*" This variety seems to have been largely disregarded by later writers. 2). Lamb., Gen. Pinus 2: 121. Tab. 65. 1832. Lambert accepts Miller's view that this tree, so widely grown in Portugal, is a native of Goa, India. His colored plate (Tab. 65) is an excellent match for the plants we have grown at Rancho Santa Ana Botanic Garden under Prop. No. 2356. 3). Carr., Traité Gén. Conif. 119. 1855. The following are listed as synonyms: *C. glauca* Brot., *C. pendula*, *C. thurifera* Hort. (non Lindl. et Gord.), *C. sinensis pendula* Hort., and *C. Uhdeana* Hort. (non Gord.). Said by Carrière to have been introduced in 1683. 4). Gord. & Glend., Pinet. 63. 1858. Ten synonyms are listed for this species. These authors call this tree the "Cedar of Goa" and apparently did not suspect that it might have come from the New World. 5). Mast., Journ. Linn. Soc. 31: 331. 1896. Masters states that Carrière considers *C. Bentharii*, *C. Uhdeana* and *C. Lindleyi* of Mexico as belonging to this species but says that he believes this is open to doubt. 6). Elwes & Henry, Trees of Great Brit. & Irel. 5: 1176. 1910. Synonyms listed are: *C. pendula* L'Herit. Stirp. 15. t. 8. 1784. *C. glauca* Lamarck, Encycl. 2: 243, 1786; *C. Coulteri* Forbes, Pinet. Woburn. 190. 1839. Of the latter they say: "The plant described as *C. Coulteri* was raised from seeds taken from a cone said to have been fifteen years old, in Coulter's herbarium." *C. Lindleyi* Klotzsch; *C. Ehrenbergii*; *C. Karwinskyana* Regel; *C. sinensis*; *C. mexicana* Koch, Dendr. 2: pt. 2. 159. 1873, are also listed as synonyms. In their treatment, these authors recognize: a). the typical form as cultivated in Portugal; b). var. *Bentharii* Carr., Conif. 155. 1867, with branchlets in one plane, and for it list the following synonyms: *C. Bentharii*, *C. thurifera* Schlecht., *C. Knightiana* Knight & Perry, *C. Uhdeana* Carr., and *C. elegans* Low.; c). var. *Skinneri*, n. var. based on specimens "collected in Guatemala by Donnell-Smith at 5000 ft.". They state that it does not differ in botanical characters; d). var. *glauca*, "with very bluish glaucous foliage." This is apparently the original description for this horticultural variety. 7). Camus, Les Cyprés 52. Figs. 185, 186. 1914. The cones shown in the figures match those of our material grown under Prop. No. 2356 at Rancho Santa Ana Botanic Garden. 8). Dalli. & Jacks., Handb. Conif. 206. Fig. 4. 1923. According to these authors, the plant described under this name has glaucous cones the first year which turn brown the second. The branchlets are pendulous. They also state: "There is good evidence that *C. lusitanica* has existed at Bussaco in Portugal for at least 300 years. the suggestion that it was introduced by the Spanish friars from Mexico seems more likely." Their Fig. 4 agrees well with the living plants grown at Rancho Santa Ana Botanic Garden under Prop. No. 2356. 9). Rehd., in Bailey, Std. Cycl. Hort.

new ed. 916. 1925. The following are listed as synonyms: *C. glauca* Lam., *C. pendula* L'Herit., and *C. sinensis* Hort. Rehder states: "Habitat unknown; cult. in Portugal and naturalized; possibly intro. from India." Rehder's treatment of *C. lusitanica* and *Benthamii* and its varieties in this work was apparently not revised for the new edition, for he had already (Journ. Arn. Arb. 1: 52. 1919) transferred *C. Knightiana* to varietal rank under *C. lusitanica*. 10). Rehd., in Bailey, Cult. Evergr. 210. 1925. The following are listed as synonyms: *C. glauca* Lam., *C. Lindleyi* Klotzsch, *C. pendula* L'Herit., and *C. sinensis* Hort. Rehder states: "Mexico—Introduced to Portugal about 1600. For a long time supposed to have come from India and called Cedar of Goa."

CUPRESSUS LUSITANICA var. *BENTHAMII* Carr., *Traité Gén. Conif.* ed. 2. 155. 1867. *C. Benthamii* Endl., *C. glauca* Forb., *C. Uhdeana* Hort., are regarded as synonyms. "Cedro, Mexic." 2). Camus. *Les Cyprès* 52. 1914. Camus characterizes this variety as having branches in one plane. 3). Dalli. & Jacks., *Handb. Conif.* 206. 1923. The following are listed as synonyms: *C. Benthamii* Endl., *C. Knightiana* Knight & Perry, and *C. lusitanica* var. *Knightiana* Rehd. According to these authors, this variety is characterized by "regularly pinnate flattened branchlet systems, the ultimate divisions more flattened and compressed than in the typical form". They also state that according to Bentham, this variety was introduced as *C. thurifera* in 1838. 4). Rehd., in Bailey, Cult. Evergr. 210. 1925. The following are listed as synonyms: *C. Benthamii* Endl., *C. thurifera* Schlecht. and *C. excelsa* Scott. According to Rehder, the branchlets are in one plane, and the leaves have a glandular pit on the back, and it is said to have been introduced about 1840.

CUPRESSUS LUSITANICA var. *GLAUCA* Elwes & Henry, *Trees of Great Brit. & Irel.* 5: 1176. 1910, "with very bluish glaucous foliage." Apparently, only an horticultural form—no specimens, etc. cited. 2). Camus, *Les Cyprès* 52. 1914. Camus characterizes this variety as having branches not in one plane.

CUPRESSUS LUSITANICA var. *KNIGHTIANA* Rehd., *Journ. Arn. Arb.* 1: 52. 1919. The following are listed as synonyms: *C. Knightiana* Knight & Perry, *C. elegans* Low ex Koch, *C. Benthamii* var. *Knightiana* Mast., and *C. lusitanica* var. *Benthamii* Henry (in part). According to Rehder, "This variety differs from the type chiefly in its distinctly pyramidal habit and in its regularly pinnate branchlet-system with the ultimate branchlets of nearly equal length and compressed". He also states that Henry had placed *C. Knightiana* with his *C. lusitanica* var. *Benthamii*, but he (Rehder) believes that the two are different in that var. *Benthamii* has less regularly disposed branchlets. 2). Rehd., in Bailey, Cult. Evergr. 210. 1925. The following are listed as synonyms: *C. Knightiana* Knight & Perry and *C.*

Benthamii var. *Knightiana* Mast. This is said by Rehder to be similar to var. *Benthamii*, "but branchlets more compressed and very regularly pinnately branched, the ultimate branchlets of nearly equal length, green to glaucous.—Introduced before 1850."

CUPRESSUS LUSITANICA PATULA Mill., Gard. Dict. ed. 8 n. 3. 1768. "Portugal spreading Cypress with smaller fruit." This variety seems to have been largely disregarded by later writers.

CUPRESSUS LUSITANICA var. SKINNERI Elwes & Henry, Trees of Great Brit. & Irel. 5: 1176. 1910. See account of this new variety by these authors under reference to *C. lusitanica*.

CUPRESSUS LUSITANICA UHDEANA Carr., Traité Gén. Conif. ed. 2. 155. 1867. *C. Uhdeana* Gord., *C. tetragona* Hort., and *C. Schomburgkii* Hort. are listed as synonyms.

CUPRESSUS AROMATICA Van Houtte ex Gord. & Glend., Pinet. 56. 1858. This is termed the "Strong-Scented Cypress". *C. kewensis* Hort., *C. californica* Carr., and *Juniperus aromatica* Hort. are listed as synonyms. "This is a robust growing kind, very much resembling the Cedar of Goa (probably not different), but said by Carrière to be from California. It emits a strong disagreeable odour when the young, soft parts of the branches are crushed between the finger and thumb." In the living collections of *C. lusitanica* at Rancho Santa Ana Botanic Garden, I have noted that the herbage, although not very strong scented, has a rather disagreeable odor similar to fish oil.

CUPRESSUS BENTHAMII Endl., Syn. Conif. 59. 1847. "Habitat in Mexici regione montana frigida." *C. thurifera* Schlecht. in Linnaea 12: 493, and *C. thurifera* Benth., Plant Hartw. n. 434, non Humb. et Bonpl. are listed as synonyms. 2). Carr., Traité Gén. Conif. 122. 1855. The following are listed as synonyms: *C. thurifera* Schlecht., *C. glauca* Forbes, *C. Uhdeana* Hort. (non Gord.). Note that Carrière also listed the latter species as a synonym of *C. lusitanica* Mill. 3). Gord. & Glend., Pinet. 58. 1858. *C. thurifera* Benth. is regarded as a synonym. According to Gordon, this cypress "was first discovered by Mr. Hartweg, and described by Mr. Bentham as the *Cupressus thurifera* of Humboldt (now *Chamaecyparis thurifera*); an error which professor Endlicher afterwards detected and changed to that of *Cupressus Benthamii*." 4). Parl., in DC. Prod. 16: 472. 1864. Hartweg n. 434 from Mexico is cited. The following are listed as synonyms: *C. lusitanica*, *C. Skinneri*, *C. elegans*, *C. aromatica* and *C. Uhdeana*. 5). Mast., Journ. Linn. Soc. 31: 338. 1896. The following are listed as synonyms: *C. thurifera* Schlecht., *C. Coulteri* Forbes, *C. Uhdeana* Gord., *C. Ehrenbergii* Kunze, *C. Karwinskyana* Regel, *C. excelsa* Gord. and *C. kewensis* Hort. According to Masters this species is restricted to "Mexici regione montana frigida" and "in Guatemala montibus." 6). Standl., Contrib. U. S. Nat. Herb. 23: 63. 1920. The following are listed as synonyms: *C. Coulteri* Forbes, *C.*

Lindleyi Klotzsch, *C. Ehrenbergii* Kunze, *C. Karwinskyana* Regel, and *C. Knightiana* Perry. Standley fails to mention *C. lusitanica* Mill. in this treatment of *Cupressus* in his *Trees and Shrubs of Mexico*. Distribution for *C. Benthamii* is given as from Tepic to Vera Cruz and from Guatemala to Costa Rica. Standley's key characterizes this species as "Branchlets slender; leaves green." 7). Rehd., in Bailey, *Std. Cycl. Hort.* new ed. 915. 1925. The following are listed as synonyms: *C. excelsa* Scott, *C. Karwinskyana* Regel, and *C. thurifera* Schlecht. According to Rehder this is a tree with slender branches and inconspicuously glandular leaves of bright green. He also states that "*C. Benthamii* has been found in prehistoric asphalt beds at Los Angeles." 8). Popenoe, *Tropical Woods* 65: 1-4. 1941. "So much for the literature. It fails to tell us that *Cupressus Benthami* (as we prefer to term it, in spite of the technical necessity of referring the species to *C. lusitanica* Mill.) yields one of the principal commercial timbers of the Guatemalan highlands, well known to every carpenter and builder throughout that region. As a wild tree it grows abundantly at elevations between 8000 and 11,000 feet in the central and northwestern parts of the republic, often attaining a height of 70 to 80 feet and a trunk diameter of five to six feet. Further, it has for many years been planted extensively not only as an ornamental but also for the production of lumber. As a cultivated tree it is most commonly seen at elevations between 4000 and 8000 feet, but it is not rare to find it in gardens and dooryards almost down to the level of the sea. It grows on soils of many different types, a notable feature being its ability to thrive on volcanic pumice where few other arborescent species are able to eke out an existence. . . . To gain an accurate idea of the value of its lumber, I have talked with Don Fernando Pullin, one of the leading lumbermen of Guatemala. 'Bentham's cypress', he says, 'has quality but not character. By this I mean that it is an excellent wood for construction purposes, but for interior finish it has not the beauty of certain other woods. Nevertheless, it is much used for siding, for ceilings, and for lining houses of the humbler sort, as well as for sills, beams and for many other purposes. In the highlands it resists exposure to the weather admirably, but on the coast it is not so satisfactory from this angle . . . ' Among the Indians of the Guatemalan highlands, Cypress is much used for construction purposes, also for furniture. In fact it is a popular favorite. It is soft and easily worked. In color and general appearance it is similar to white pine."

CUPRESSUS BENTHAMII var. *KNIGHTIANA* Mast., *Journ. Linn. Soc.* 31: 340. 1896. The following are listed as synonyms: *C. Knightiana* Knight & Perry, and *C. elegans* Hort. 2). Rehd., in Bailey, *Stand. Cycl. Hort.* new ed. 915. 1925. *C. elegans* Hort. is listed as a synonym. This variety is characterized by Rehder as having "branchlets very regularly arranged, fernlike, drooping, glaucous."

CUPRESSUS BENTHAMII var. *LINDLEII* Mast., Journ. Linn. Soc. 31: 339. 1896. The following are listed as synonyms. *C. Lindleyi* Klotzsch in Endl., *C. thurifera* Lindl. and *C. cornuta* Carr. 2). Rehd., in Bailey, Stand. Cycl. Hort. new ed. 915. 1925. According to Rehder, this differs from *C. Benthamii* in having "branchlets regularly arranged, of nearly equal length."

CUPRESSUS COULTERI Forbes, Pinet. Woburn. 190. 1839. "*CUPRESSUS COULTERII* Dr. Coulter's Cypress. Leaves in threes, ovate, acute, imbricated, glaucous, slightly concave on the inner side, convex on the exterior. Branches round, aspiring (sic), of a reddish brown colour. This appears to be a distinct growing plant from any of the species of *Cupressus* that I am acquainted with. It was discovered in Mexico, by Dr. Coulter; and the plant now in the collection at Woburn Abbey was raised from seeds by Mr. Niven, of the Dublin Glasnevin Botanic Garden, which he procured from the specimens in Dr. Coulter's Herbarium, and which had been fifteen years gathered previous to sowing. It is a handsome growing tree, producing numerous erect branches, which are covered with reddish brown bark. After the first year growth, the young shoots are of a light glaucous green hue, and thickly set with ovate-acute leaves, which are a little decurrent at the base, ternate, loosely imbricated on the lower part of the young plant; but those towards the extremity adhering more closely to the branchlets, which give them somewhat a triangular appearance. I have not yet exposed this species to the inclemency of the weather throughout the winter months; and am, consequently, unable to say whether it is likely to resist the intensity of our frost or not at the present time: but it appears to flourish well out of doors during the summer season. Native of Mexico." 2). Endl., Syn. Conif. 60. 1847. Listed under "species inquirendae". "Habitat in Mexico."

CUPRESSUS EHRENBERGII Kunze, *Linnaea* 20: 16. 1847. "Semina e Mexico benevole misit cl. C. Ehrenberg a. 1839. Plantae orgyalis primum flores femineas explicarunt majore a. 1844; sed fructus non maturarunt. Planta sunt frigoris impatientes."

CUPRESSUS EXCELSA Scott ex Gord. & Glend., Pinet. 58. 1858. This is called the "Tall Guatemala Cypress". *C. Skinneri* Hort. is listed as a synonym. *C. excelsa* is here characterized as having glaucous foliage, branchlets drooping on adult plants, cones nearly $\frac{3}{4}$ in. in diameter, with 6 to 8 scales. It is also said to be "a large tree, growing 100 feet high, on the mountains of Santa Cruz and Kachequil in Guatemala, producing excellent timber which is very durable."

CUPRESSUS GLAUCA Lam., Encyc. 2: 243. 1786. 2). Brot., Fl. Lusit. 1: 216. 1804. *C. lusitanica* regarded as a synonym, called "Cedro de Goa". 3). Endl., Syn. Conif. 58. 1847. Synonyms listed are: *C. lusitanica patula*, *C. lusitanica* Mill., and *C. pendula*. 4). Parl. in DC. Prod. 16: 470. 1864. *C. lusitanica* Mill. is regarded as a synonym. Distribution given as "Indiae circ. Goam."

CUPRESSUS KARWINSKYANA Regel, Gartenfl. 1857: 346. 1857. "Eine schoene neue Cupresse, deren Samen der hiesige Garten aus dem suedlichen Californien erhielt. Auch Karwinsky schichte die gleiche Art in fruchttragenden Exemplaren aus Mexico." This species was published by Dr. Regel along with several other plants which were either new or interesting in the St. Petersburg Botanic Garden. However, it never seems to have been given serious consideration as a distinct species by other botanists.

CUPRESSUS KNIGHTIANA Knight & Perry, Synop. Conif. 19. 1850. "This is a very beautiful species presenting, even when quite young, an elegant appearance, unlike that of any other kind. If it proves hardy, as it is hoped it will, it will be a valuable addition to the Cypresses already common in our gardens. The origin of the species is unknown." 2). Hort. ex Carr., Traité Gén. Conif. 127. 1855. *C. Knightiana* Hort. in Knight Syn. Conif. 20 and *C. elegans* Hort. are listed as synonyms. "Habite le Mexique." "Introduit 1840." 3). Perry ex Gord. & Glend., Pinet. 61. 1858. Synonyms listed are: *C. Lindleyi* Klotzsch, *C. Coulteri* Forbes, *C. thurifera elegans* Hort., and *C. thurifera Knightiana* Gord. According to this paper, this species grows to 120 feet in height in the mountains of Mexico and is much hardier in England than *C. Benthamii* with which it has been confused. It is stated that Mr. Perry detected the mistake and named this plant in compliment to Mr. Knight of Chelsea.

CUPRESSUS LINDLEII Klotzsch ex Endl. Syn. Conif. 59. 1847. "Habitat in Mexico, inter Anganguio et Tlalpuxahua." Synonyms cited are: *C. thurifera* Lindl. in Bot. Reg. 1839, append. p. 64., Benth. Plant. Hartw. n. 437, non Humb. et Bonpl.; *C. Lindleyi* Klotzsch msc.; and *C. Lambertiana* Hort. 2). Carr., Traité Gén Conif. 123. 1855. Synonyms are listed as follows: *C. thurifera* Lindl., *C. Coulteri* Forbes, and *C. tetragona* Hort. 3). Parl., in DC. Prod. 16: 471. 1864. Synonyms listed are: *C. thurifera* Lindl., *C. lusitanica* Lindl., and *C. Knightiana* Carr.

CUPRESSUS MEXICANA Koch, Dendr. 2: pt. 2. 159. 1873. Nomen in synonymy of *C. thurifera*.

CUPRESSUS MEXICANA GLAUCA Koch, Dendr. 2: pt. 2. 159. 1873. Nomen in synonymy of *C. pendula* L'Herit.

CUPRESSUS PENDULA L'Herit., Stirp. Nov. 15. t. 8. 1784. *C. lusitanica* Mill. and *C. lusitanica patula* are regarded as synonyms. The illustration bears one ovulate cone, and the foliage is typical of our *C. lusitanica* (Prop. No. 2356).

CUPRESSUS SINENSIS Lee ex Gord. & Glend., Pinet. 63. 1858.

CUPRESSUS THURIFERA Schlecht. in Linnaea 12: 423. 1838. This author thought he was treating *C. thurifera* H. B. K. but apparently had material of *C. lusitanica* Mill. 2). Lindl., Bot. Reg. New Series 12: misc. 64. 1839. "Found near Anganguco and Tlalpuxahua, form-

ing a tree 50 to 60 feet high." This is the name applied by Lindley to Hartweg's Mexican seeds collected by him in 1838, and which were to be distributed at that time by Lindley.

CUPRESSUS UHDEANA Gord., in Lindl. & Gord. nomen nudum in Journ. Hort. Soc. London 5: 206. 1850. "A tree . . . Mexico." 2). Carr., Traité Gén. Conif. 3rd ed. 129. 1855. "Habite le Mexique." *C. Uhdeana* Gord., msc. Lindl. et Gord., Journ. Hort. Soc. 5: 206. 1850, is listed as a synonym. 3). Gord. & Glend., Pinet. 71. 1858. *C. tetragona* Hort. is listed as a synonym, and it is "a handsome small tree, with a dense bushy head, growing 40 or 50 feet high, and first discovered by Mr. Uhde on the Real Del Monte and other mountains, in Mexico, in high, exposed situations, at an elevation of from 6000 to 7000 feet." According to Gordon, this tree has very glaucous leaves and small very glaucous cones.

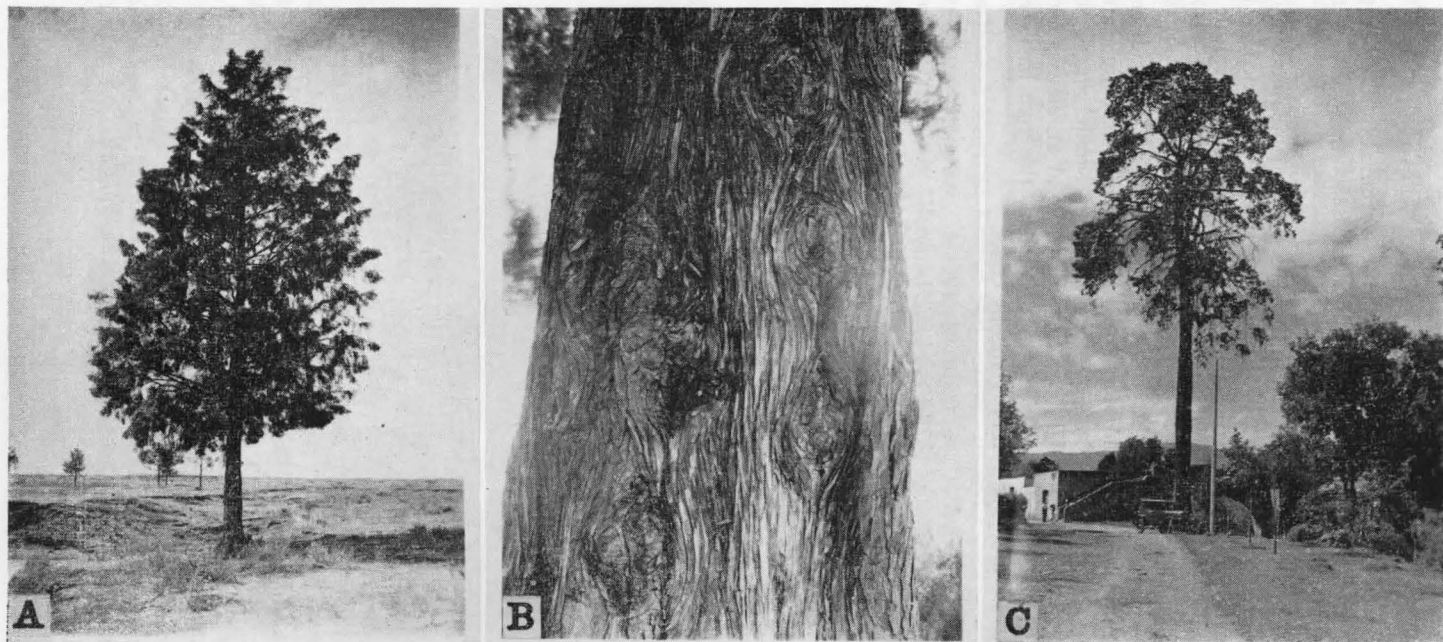


FIGURE 29.

CUPRESSUS LUSITANICA—Mexican Cypress. Photos by Eric Walther, fall, 1935.

A—Tree near the Pedregal, San Angel, Mexico, about 8-10 m. high.

B—Trunk of same tree showing fibrous bark.

C—A fully mature tree near Mexico City.

9. CUPRESSUS FORBESII—Tecate Cypress*

Cupressus Forbesii Jepson, Madroño 1: 75. 1922. Small tree usually less than 10 m. high (mainly 6 or 7 m.) and with an irregular, spreading crown 4 to 6 m. broad, the main trunk 3 to 5 dm. in diam., but usually soon branching into numerous ascending branches. Bark exfoliating, leaving a clear mahogany-brown or rich cherry-red smooth surface, the bark itself devoid of fibrous or stringy material and less than 1 cm. in thickness. On occasional trees in sheltered canyons, the bark does not completely exfoliate each season, and the thin crisp plates peel off only partially and curl up at their tips in numerous layers. In such instances, this bark falls to the ground with the slightest disturbance. In some localities on exposed ridges in sterile, rocky soil or on old burns that have reseeded heavily, the trees are dwarfs and may produce cones on individuals less than 1 m. high, with trunks only 2 or 3 cm. in diam. Sometimes these cane-like trees are so crowded that they stand only a few dm. apart and may have a height of 2 to 3 m. with a cherry-barked trunk only 2 to 3 cm. in diam. but may be 20 or 30 years old. In general aspect, the trees are a light rich green, especially when there is an abundance of new growth, and are never blue-glaucous or gray-green, but in late summer or fall prior to the winter rains, the foliage is often a little dull green. The branches are usually flexible; and, although ascending at first, often become weighted down with foliage and cones and are thus horizontal or even deflexed. Branchlets rather slender, those of the season 8 to 15 mm. long, 1.0 to 1.4 mm. in diam. (rarely as much as 2 mm. thick). Leaves acute, but rather blunt-tipped, 1.5 mm. long by about 1.0 mm. broad, rounded or ridged on back, usually (even when very young) bearing an inconspicuous, slightly darkened dorsal pit, which seems always to remain closed and non-functional. On very vigorous branches the leaves elongate greatly and may become 20 mm. long by 3 to 4 mm. broad, and have acutely-pointed tip with a minute prickle, and this portion is not appressed. Even shorter leaves of this type (those 5 to 6 mm. long) develop acute spreading tips and have very conspicuous ciliate margins when examined under a lens. On such elongated leaves, the dorsal pit also elongates and may become 2 mm. long, but seems to disappear in age. These elongated leaves usually are on vigorous branches and, as a result are of short duration, turning brown within a few months and are pushed off by the expanding bark beneath. Staminate cones abundant, produced on comparatively young trees (6 or 7 years old), on branchlets which usually have the leaves slightly more imbricated than on vegetative branchlets; cones 3 to 4 mm. long, about 2 mm. thick, a little 4-sided, and nearly

*Forbes Cypress is sometimes used instead and is not objectionable except that the Mexican name has unquestionable priority of usage, having been used in print by Parish in 1914.

as thick at the blunt apex as at the base; cone scales generally 12 to 14 but sometimes only 8 or 10, less than 2 mm. broad, the broadly triangular and obtuse apex frequently very abruptly contracted to a minute point; lower and upper scales bearing only 3 or 4 pollen sacs, the central ones usually with 5 sacs. Ovulate cones usually abundant, sometimes congested into clusters of 15 or 20; at first visible as swollen tips on the short branchlets which are often 5 to 6 mm. long, bearing well imbricated leaves and are thicker than either the vegetative or staminate branchlets; cone scales 6 to 10 with most cones composed of 8 or 10 scales. During the first season, the ovulate cones turn from green to a rich brown and attain a size of about 1 cm. in length, the shape is usually irregular and the umbos are conspicuous. At maturity the cones become dull brown or gray, are usually globose and may attain a length of over 30 mm., but are usually somewhat less in diam. The umbos may be very inconspicuous or as much as 4 or 5 mm. high. The branchlet bearing the mature cone may be as much as 3 to 4 mm. in diam. but is usually less than 10 mm. long. After maturity the cones appear to remain unopened on the trees for many years. Seeds very large, rich dark brown, with a lighter hilum 1 to 2 mm. long, surface sparingly papillate with raised pitch pockets. Largest seeds about 6 mm. long, very angular or even somewhat rounded and much thickened, usually less than 4 mm. broad, the wing thin and nearly 1 mm. broad. In germination the seed coat is carried above the ground by the 3 to 6 cotyledons which expand to push off the seed coat and then become spreading at nearly right angles to the main axis. Cotyledons up to 15 mm. long when fully developed, linear, but slightly flattened and with a blunt tip. Next leaves in whorls of 4, rarely over 10 mm. long, the later ones becoming much shorter and broader in proportion, all with a minute prickle or spine at the tip. During or after the second year, the branchlets produce leaves increasingly like the mature type and even some of the juvenile ones show an elongated dorsal pit.

Type Locality

"This cypress was discovered Dec. 30, 1907, in Cedar Cañon between El Nido and Dulzura, San Diego County, by my former student Mr. C. N. Forbes, later Assistant in Botany, Bishop Museum, Honolulu. I take pleasure in naming it in his memory. The same thing, apparently has also been found on Mt. Tecate and near Pala by Mr. S. B. Parish but I have not seen his specimens:" Jepson, *Madroño* 1: 75. 1922. The type specimen is in the Jepson Herbarium, Berkeley, California. Isotype at Rancho Santa Ana Botanic Garden.

The Cedar Cañon referred to above by Prof. Jepson lies on the north side of Otay Mountain in San Diego County and drains into Dulzura Creek scarcely a mile above (northeast of) its junction with Jamul Creek. The mouth of Cedar Cañon is about 700 ft. in elevation

while its extreme head is at about 3000 ft. in elevation and is near the main ridge less than a mile to the north of the main peak of Otay Mountain (3572 ft.).

Under date of March 10, 1943, Dr. W. L. Jepson has written me data concerning Charles N. Forbes, for whom he named *C. Forbesii*. "In August, 1904, Charles N. Forbes of National City, San Diego County, entered the College of Agriculture of the University of California as a freshman On one of his vacations he undertook a trip (Dec. 30, 1907) to Cedar Cañon in San Diego County and collected the peculiar cypress which grows between El Nido and Dulzura. This cypress he identified as conspecific with the Guadalupe Island Cypress, *Cupressus guadalupensis* Wats. . . . I, myself, later, decided that the tree collected by Forbes represented a distinct species and I named it *Cupressus Forbesii*, but the manuscript name (as in the case of names of many other new species) lay dormant in the working collection of the Flora of California for many years. Forbes, meantime, after graduation, in 1908, had become Assistant in Botany at the Bishop Museum in Honolulu. Here he remained until his death in 1920. It was this event which finally precipitated publication of *Cupressus Forbesii*, because I desired to associate his name with the cypress he had collected, studied and made known. The species by means of its name now stands as a memorial to the steady patience, sound observation and powers of rigid analysis in scientific work of a student who was whole-heartedly devoted to the best ideals in botanical science."

Range

United States. California:

1. Orange County: Santa Ana Mountains; on the slopes of Sierra Peak and a few stray trees in the adjacent Santa Ana River bottom.

2. San Diego County: Guatay Mountain, near Descanso; Mount Tecate; Otay Mountain; also reported from near Pala and on Little Tecate Mountain, but I have not been able to verify these two references.

Mexico. Baja California:

1. Mount Tecate on the United States Boundary.

2. El Cañon de Pinitos, which is west of San Antonio Mesa, between Rio San Ysidro and Rio San Antonio (or approximately 70 miles south of Ensenada).

The distribution of *Cupressus Forbesii* in California is of interest in that as far as is now definitely known there are but four groves or areas as mentioned above. With the exception of the stray trees at the base of Otay Mountain and Sierra Peak, all of the groves are

located in essentially mountainous chaparral of the typical Upper Sonoran Life Zone and are in coarse rocky and sterile soils, in areas receiving an average rainfall of 10 to 20 inches per year. All of the California groves appear to be essentially composed of young trees; that is, fires within recent times have prevented the survival of old or over-mature trees. As a result, the present groves do not give a true picture of the real size to which this species would grow if permitted. The abundant production of cones and their remaining closed over several years are effective means of insuring reproduction following a fire, but also appear to be the main reason for the thickets of dwarfed trees in some of the areas.

Localities

1. Sierra Peak, Santa Ana Mountains, Orange County, California. This grove is in the extreme north end of the Santa Ana Mountains and is largely confined to the northwest slopes of Sierra Peak, whose summit is 3045 ft. in elevation. The main area covered by *C. Forbesii* lies at the heads of Claymine (Clay) Canyon and Gypsum Canyon, both of which drain into the Santa Ana River. A road from Claymine Canyon passes through the approximate center of the grove at an elevation of about 1500 ft., and from there ascends to a main east and west ridge near whose summit the Gladding-McBean Clay Products Company mines clay from an open pit. Some good-sized trees 5 to 8 m. high occupy the floor of Claymine Canyon and also of Gypsum Canyon, and a few trees have been found in the Santa Ana River bottom, of which several are on the north side of the river and at least one mile northwest of the mouth of Gypsum Canyon. The main grove, as mentioned above, occupies an area of at least 1000 acres, of which parts are practically pure stands of dwarfed trees. Many of these stand only a few dm. apart, are 2 to 3 m. high, have trunks only 2 or 3 cm. in diam., but whose bark is as bright red and smooth as any large trees of this species. In adjacent areas slightly larger trees with trunks about 1 dm. or larger have been consistently cut for fence posts for many years. Perhaps, the most interesting trees in this locality are the dwarfs on the exposed ridge at about 2000 ft. in elevation. These are miniature trees in every sense of the word, have well rounded crowns 4 to 6 dm. high, trunks about 2 cm. thick with very closely formed annual rings, but which appear to range from 10 to 20 years in age, and even some of these bear cones with good seeds. Surrounding this grove and somewhat intermingled with it are thickets of *Adenostoma fasciculatum*, *Ceanothus megacarpus* and *C. crassifolius*, *Eriodictyon crassifolium*, *Salvia mellifera* and some *Cercocarpus betuloides*.

Collections:

a). J. G. C., May 20, 1872, Santa Ana Mountains. This specimen in the University of California Herbarium is of interest as it

seems probable that it was collected by J. G. Cooper, the ornithologist; and is, possibly, the first record of the species from the Santa Ana Mountains; b). R. Bacigalupi, No. 2354 (R. S. A.), June 22, 1935, from head of Claymine Canyon; c). J. T. Howell, Coll. No. 226, June 26, 1927, Claymine Canyon at 2300 ft.; d). J. T. Howell, Coll. No. 621-A (Prop. No. 221), August 10, 1927, Claymine Canyon at 1200 ft., cones over 30 mm. long and with large umbos; e). B. D. Stark, Coll. No. 2247 (Prop. No. 1111), June 10, 1931, Claymine Canyon at 650 ft.; f). B. D. Stark, Coll. No. 4532 (Prop. No. 1783), March 17, 1933, Claymine Canyon at 2000 ft. A series of 7 specimens numbered a to g, each from a separate tree; g). C. B. Wolf, Coll. No. 6278 (Prop. No. 2319, our Sierra Peak No. 1 Strain), January 2, 1935, from slopes of Sierra Peak at 2200 ft., from a tree 6 to 7 m. high, 6 to 7 m. in spread and with a trunk 5 dm. in diam.; h). C. B. Wolf, Coll. No. 6279 (Prop. No. 2320, our Sierra Peak No. 2 Strain), January 2, 1935, from the slopes of Sierra Peak at 2200 ft., from a tree 6 to 7 m. high, 6 to 7 m. in spread and with a trunk 1.5 dm. in diam.; i). C. B. Wolf and E. R. Johnson, Coll. No. 5578, March 21, 1934, from the Santa Ana River bed, north of the river and southwest of the Mexican Village, Rancho Santa Ana, from a lone tree 8 m. high, 6 to 7 m. in spread and with a trunk 3.5 dm. in diam.

2. Guatay Mountain, San Diego County. This is an isolated grove, limited in extent, but of easy access. U. S. Highway No. 80 from San Diego to Imperial Valley passes on the north side of Guatay Mountain, whose summit is approximately 5000 ft. in elevation. From this highway the rather scrubby cypress trees can be seen on the gentle north slope, rising a little above the chaparral growth which is composed of *Ceanothus*, *Arctostaphylos* and *Cercocarpus*. From the Guatay Public Camp of the United States Forest Service, one can easily walk up to the cypress trees in less than 5 minutes despite the lack of a trail. The soil on Guatay Mountain is of a reddish granite formation, and there is little annual growth upon this coarse surface, so that cypress seedlings are able to survive. The trees of *C. Forbesii* are a comparatively insignificant part of the total vegetation on Guatay Mountain and are not of large size, but do stand out on the slope because the surrounding chaparral is on the average only about 3 m. high, whereas, most of the cypress are 5 m. or more in height.

The nearest known station for *C. Forbesii* is on Mount Tecate, approximately 20 miles to the south and a little west. However, some 7 or 8 miles north and a little west on the southwest slopes of Cuyamaca Peak is a grove of cypress which when first brought to our attention was thought to be *C. Forbesii*, but which is here described as new under the name of *C. Stephensonii*.

Collections:

a). C. B. Wolf, Coll. No. 6268 (Prop. No. 2314, our Guatay Mountain No. 1 Strain), December 28, 1934, from about 4200 ft. elevation from a tree about 5 m. high, 3 m. in spread and with a trunk 2.5 dm. in diam. A branch from this tree 5-6 cm. in diam. was 47 years old; b). C. B. Wolf, Coll. No. 6269 (Prop. No. 2315, our Guatay Mountain No. 2 Strain), same data as the above, but from a tree 4 m. high, 3 m. in spread and with a trunk 1.5 dm. in diam. Both of these collections had cones with rather prominent conical umbos, mostly 6 scales and the cones mostly 20 mm. or less in diam.

3. Mount Tecate, San Diego County. Mount Tecate, San Diego County lies on the Mexican Boundary with its summit on the California side reaching an elevation of 3890 ft. The Potrero Grade from Barrett on Cottonwood Creek to Dulzura winds up along the north base of the mountain, and from the road about 3.5 miles up the grade, cypresses can easily be seen in the canyons or draws leading off to the south. A few cypresses grow to the north of the road on the slopes above Potrero Creek. The slopes of Mount Tecate are essentially made up of granitic soil with many large granite boulders exposed. However, since it is a north slope, there is considerable humus from the leaves and dead portions of the numerous chaparral plants, of which *Adenostoma fasciculatum*, *Cneoridium dumosum*, *Cercocarpus betuloides*, *Ceanothus leucodermis*, *Xylococcus bicolor* and *Chamaebatia australis* are the most abundant.

The largest trees of *Cupressus Forbesii* on Mount Tecate appear to be those in somewhat sheltered north slope canyons, of which some are about 10 m. high and have trunks about 4 dm. in diam. These are probably also the largest known wild trees of this species. One feature noticed about the main trunks of many of these trees in these sheltered canyons was that the exfoliating bark remained loosely covering the trunks, but that it could be lifted off with no effort. I concluded that this was due to the protection from winds which on exposed spots would promptly blow the loose bark from the trunks.

According to the late S. B. Parish (California Cultivator, April, 1914), there are trees on the summit of Mount Tecate whose wind swept tops are less than 8 m. high, but whose trunks reach nearly 1 m. in diam. However, I have not been to the summit of this mountain.

Since a large part of Mount Tecate is difficult to walk over, the real extent of the cypresses is unknown, but it appears from observations on numerous occasions, that the trees occupy a considerable portion of the north slope above 2000 ft. elevation and probably range over onto the Mexican side of the mountain also.

Collections from the California side of Mount Tecate:

a). C. B. Wolf, Coll. No. 1913, March 15, 1931, from 2500 ft. elevation, from a tree about 8 m. high, 8 m. in spread and with a

trunk 2.5 dm. in diam.; b). C. B. Wolf, Coll. No. 6280 (*Prop. No. 2330*, our Mount Tecate No. 1 Strain), January 16, 1935, 2000 ft. elevation, from a tree 9 m. high, 8 m. in spread and with a trunk 4 dm. in diam.; c). C. B. Wolf, Coll. No. 6281 (*Prop. No. 2331*, our Mount Tecate No. 2 Strain), January 16, 1935, 2000 ft. elevation, from a tree 7 to 8 m. high, with a 5 m. spread and a trunk 2 dm. in diam.

4. Otay Mountain, San Diego County. Otay Mountain, San Diego County is a rather large mountain on the Mexican border whose summit of 3572 ft. is not much over 10 miles west of Mount Tecate and about 3 miles north of the Mexican border. Rising, as it does, from close to sea level, Otay Mountain stands out as a rather conspicuous part of the landscape and has a considerable bulk above 2000 ft. in elevation which is approximately 4 to 5 miles east and west by 3 to 4 miles north and south. A truck trail built by the Civilian Conservation Corps begins near the mouth of Cedar Canyon on the northwest side of Otay Mountain and soon climbs to over 2500 ft. elevation where it runs through almost solid stands of *Cupressus Forbesii*. These stands of cypresses appear to occupy a large part of the upper portion of this mountain above 2000 ft., but because of lack of trails and time, I have not been able to determine the real extent of the trees. However, I estimate that the number of individual trees of *C. Forbesii* or the acreage occupied by them is greater than that of all the other California localities for the species. In the canyons on the northwest side of Otay Mountain, the cypresses descend to the base of the mountain, and a few trees are adjacent to the road along the south and east end of Otay Lake, but these trees are strays from the main forest above and in extremely dry seasons suffer severely from drouth. If there are any large trees of *Cupressus Forbesii* on Otay Mountain, they must be in the upper parts of Cedar Canyon where the essentially north slopes would provide more moisture and protection, but I have not explored that portion of the mountain. The brushy cypress growth mentioned above as occupying the upper parts of the mountain is made up largely of individuals only 3 or 4 m. high.

Collections:

a). *Forbes*, Dec. 30, 1907. Type Set (Jepson Herb., R. S. A.); b). B. D. Stark, Coll. No. 800 (*Prop. No. 310*), Nov. 1, 1927; c). C. B. Wolf, Coll. No. 6285 (*Prop. Nos. 2335 and 2336*, our Otay Mountain Nos. 1 & 2 Strains), January 17, 1935, on the ridge about 3.5 miles above the Civilian Conservation Corps Camp, along the road to the summit of Otay Mountain, at about 2000 ft. elevation, in what appeared to be serpentine or similar type rock, from a tree 6 to 7 m. high, with 4 m. spread and a trunk 1.5 dm. in diam.; d). C. B. Wolf, Coll. No. 6284 (*Prop. No. 2334*, our Otay Dam No. 3 Strain), January 17, 1935, from 1.1 miles east of Otay Lake Dam,

at about 700 ft. elevation, from a tree 8 m. high, with 6 to 7 m. spread, and a trunk 2 dm. in diam., with weeping branches; e). C. B. Wolf, Coll. No. 6282 (Prop. No. 2332, our Otay Dam No. 1 Strain), January 16, 1935, 1.1 miles east of Otay Lake Dam at about 700 ft. elevation, a very much-branched tree 6 to 7 m. high, with 8 m. spread, a trunk 4.5 dm. in diam. at the ground and cones 30 mm. long; f). C. B. Wolf, Coll. No. 6283 (Prop. No. 2333, our Otay Dam No. 2 Strain), January 17, 1935, 1.1 miles east of Otay Lake Dam at about 700 ft. elevation, from a tree about 8 m. high, with 8 m. spread, and a trunk diam. of 3 dm. This tree had large cones, thick branches and a yellowish cast to the foliage, as if over-mature or dying.

5. Baja California, Mexico. The following collections are from an area in Baja California, about 70 miles south of Ensenada. The only other area of Baja California where this species occurs is on the California boundary at Mt. Tecate and, possibly, at Otay Mountain. Both of these mountains are partly in California and partly in Baja California, but in neither instance, do I have herbarium materials.

Collections:

a). Carl Epling and Wm. Stewart (R. S. A.), April 11, 1936, Pine Canyon, 6 miles south of San Vicente, cones with very prominent umbos; b). Carl Epling and Wm. Stewart (R. S. A.), April 11, 1936, Cypress Canyon, San Antonio Mesa, cones very large (one 34 mm. long), umbos inconspicuous.

Collections of Cultivated Specimens

a). P. C. Everett, Coll. No. 7808, May 19, 1936, seedlings of Prop. No. 2314, from 4 in. pots in Garden nursery, seed flat planted March 28, 1935; 14 and 18 cm. high, with juvenile spreading leaves; root system very well developed with ample fibrous roots. b). P. C. Everett, Coll. No. 7809, May 19, 1936, seedlings of Prop. No. 2315, from 4 in. pots in Garden nursery, seed flat planted March 28, 1935; 17 and 18 cm. high, with juvenile spreading leaves; root system very well developed with ample fibrous roots. c). P. C. Everett, Coll. No. 7810, May 19, 1936, seedlings of Prop. No. 2319, from 4 in. pots in Garden nursery, seed flat planted March 28, 1935; 18 and 20 cm. high, with juvenile spreading leaves; root system only fair. d). P. C. Everett, Coll. No. 7811, May 19, 1936, seedling of Prop. No. 2320, from 4 in. pot in Garden nursery, seed flat planted March 28, 1935; 32 cm. high, with juvenile spreading leaves; root system fairly well developed but not with many fibrous roots. e). P. C. Everett, Coll. No. 7812, May 19, 1936, seedlings of Prop. No. 2330, from 4 in. pots in Garden nursery, seed flat planted March 28, 1935; 16 and 17 cm. high, with juvenile spreading leaves; root systems well developed, but not with many fibrous roots. f). P. C. Everett,

Coll. No. 7813, May 19, 1936, seedlings of *Prop.* No. 2331, from 4 in. pots in Garden nursery, seed flat planted March 28, 1935; 13 and 15 cm. high, with juvenile spreading leaves; root system very well developed g). P. C. Everett, Coll. No. 7814, May 19, 1936, seedling of *Prop.* No. 2332, from 4 in. pot in Garden nursery, seed flat planted March 28, 1935; 25 cm. high, with juvenile spreading leaves; root system well developed. h). P. C. Everett, Coll. No. 7815, May 19, 1936, seedlings of *Prop.* No. 2333, from 4 in. pots in Garden nursery, seed flat planted March 28, 1935; 18 and 22 cm. high, with juvenile spreading leaves; root system very well developed with ample fibrous roots. i). P. C. Everett, Coll. No. 7816, May 19, 1936, seedlings of *Prop.* No. 2334, from 4 in. pots in Garden nursery, seed flat planted March 28, 1935; 15 and 19 cm. high, with juvenile spreading leaves; root system very well developed, with ample fibrous roots. j). P. C. Everett, Coll. No. 7817, May 19, 1936, seedlings of *Prop.* No. 2335, from 4 in. pots in Garden nursery, seed flat planted March 28, 1935; 22 and 23 cm. high, with juvenile spreading leaves; root system very well developed. k). P. C. Everett, Coll. No. 7818, May 19, 1936, seedlings of *Prop.* No. 2336, from 4 in. pots in Garden nursery, seed flat planted March 28, 1935; 17 and 19 cm. high, with juvenile spreading leaves; root system very well developed.

Relationships

There seems to be little doubt as to the close relationship existing between *C. Forbesii* and *C. guadalupensis*. The foliage of the two species is remarkably alike, despite the fact that the leaves of *C. Forbesii* are a bright light green or occasionally a little dull green, while those of *C. guadalupensis* are bluish-green or somewhat glaucous. Both species have exfoliating cherry-like bark, and a crown made up of several leaders rather than a straight central trunk. Both have large cones with large brown or tan seeds. *C. Forbesii* was long confused with *C. Goveniana*, despite the cherry bark and large cones of the former. *C. guadalupensis* makes a much more massive and taller tree in age than does *C. Forbesii*. With the limited material of *C. guadalupensis* examined, it would seem that the staminate cones generally have as many as 18 scales and are, therefore, much larger than those of *C. Forbesii* which have only 12 or 14 scales. I believe that both *C. Forbesii* and *C. guadalupensis* are more closely related to the *C. macrocarpa* group of species than to the *C. arizonica* group.

References

CUPRESSUS FORBESII Jepson, Madroño 1: 75. 1922. Original description, see discussion under Type Locality in text. 2). Jepson, Man. Fl. Pl. Calif. 58. 1923, in part, except for the Pala locality

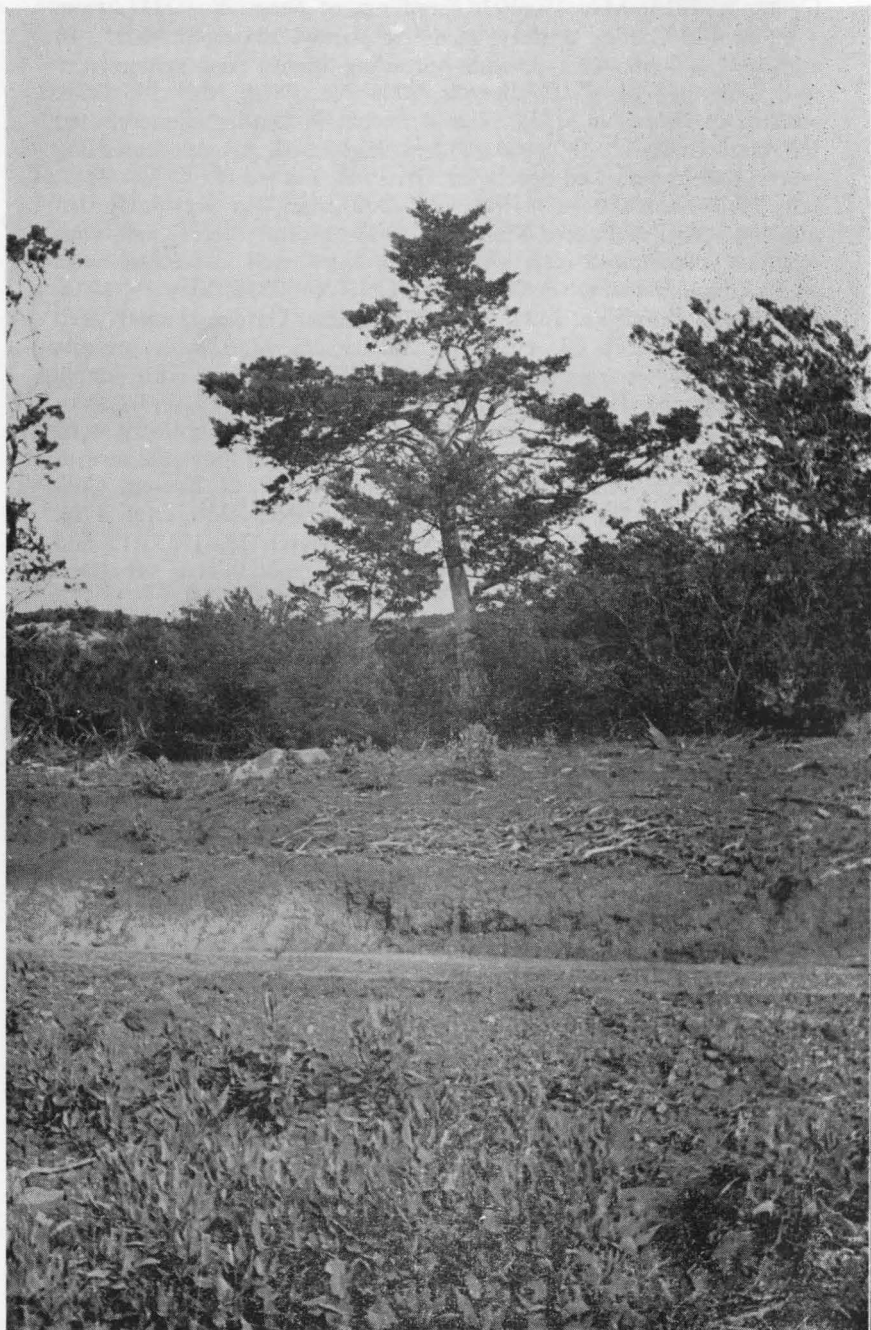


FIGURE 30. *Cupressus Forbesii*.

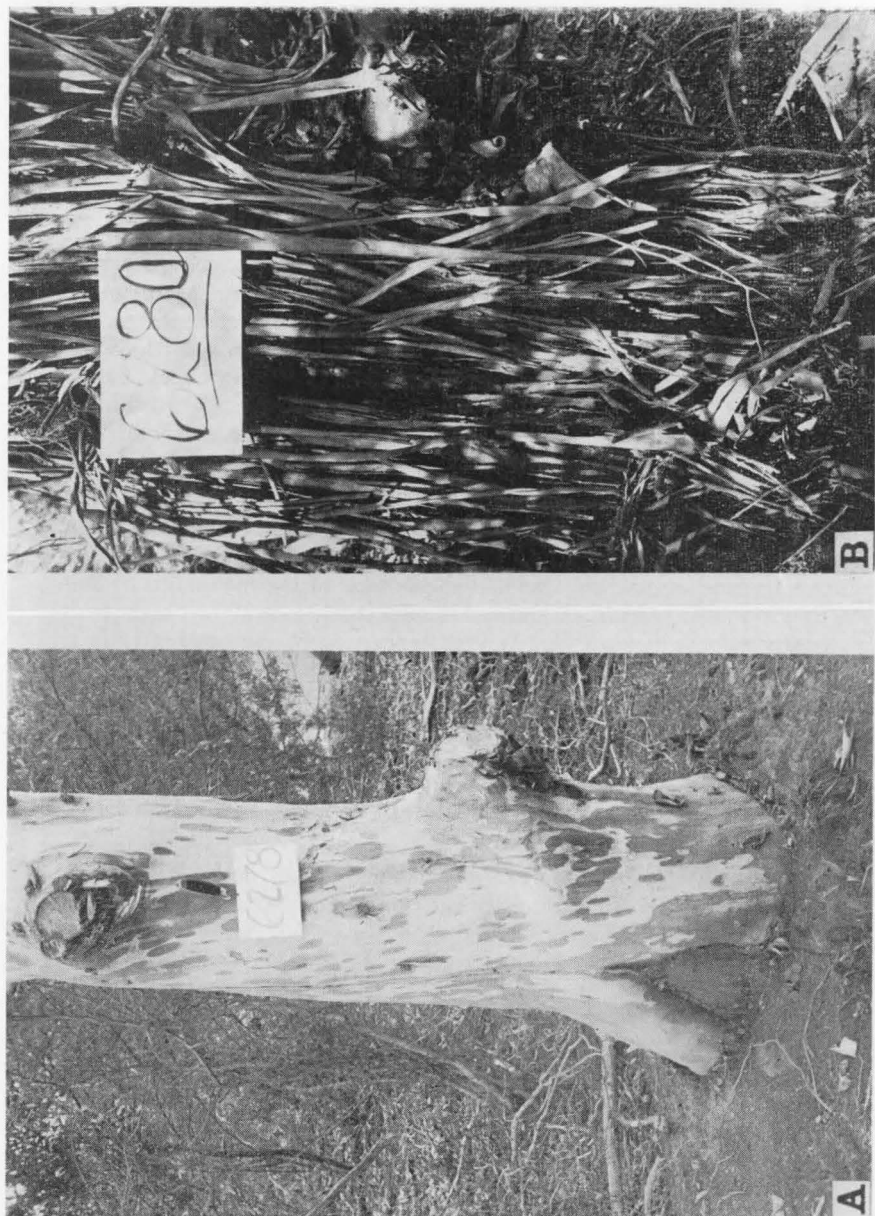
which has never been authenticated (see discussion under distribution of this species and the Parish (1915) reference). 3). Munz, Bull. South. Calif. Acad. Sci. 23: 127. 1924. This is a report of this species in the Santa Ana Mts., Orange Co., Calif. 4). J. T. Howell, Madroño 1: 250 & 252. 1929. In writing on the flora of the Santa Ana Canyon region, Orange Co., Calif., Howell says: "*Cupressus Forbesii*, here at the northern limit of its range, forms interesting colonies in the chaparral generally as shrubby densely branched trees less than 30 feet high." (p. 250). "Even several specimens of *Cupressus Forbesii* are to be found in the river bottom." (p. 252). 5). Munz, Man. South. Calif. Bot. 18. 1935. With the exception of the reference to the distribution of this species at Pala. 6). C. B. Wolf, Proc. Fifth West. Shade Tree Conf. 40. 1938, in part, except for the King Creek, Cuyamaca Mts. locality. 7). Epling & Robison, Madroño 5: 248-50. Pl. 25. 1940. This is a report of *C. Forbesii* in Baja California in a local area west of San Antonio Mesa, between Rio San Ysidro and Rio San Antonio, seventy miles south of Ensenada.

CUPRESSUS GOVENIANA Engelm., in Brew. & Wats. Bot. Calif. 2: 114. 1880, in part, as to distribution in San Diego Co., Calif. "To this species also probably belongs the cypress of the mountains of San Diego County, which is a low and slender tree, 15 or 20 feet high, with nearly smooth reddish bark." This appears to be the earliest printed reference of material of *C. Forbesii*. 2). Sarg., Silva No. Am. 11: 107. 1896, in part, as to distribution in San Diego Co., Calif. 3). Sudw., For. Trees Pac. Slope 161. 1908, in part, as to the distribution in San Diego Co., Calif. 4). Camus, Les Cyprès 48. 1914, in part, as to the distribution in San Diego Co., Calif. 5). Dalli. & Jacks., Handb. Conif. 198. 1923, in part, as to the distribution in San Diego Co., Calif.

CUPRESSUS GUADALUPENSIS Lemm., West. Am. Conebearers 3rd ed. 76. 1895, in part, as to distribution on "coast of San Diego Co.". 2). Lemm., Sierra Club Bull. 4: 116. 1902, in part, as to the distribution: "vicinity of San Diego". 3). Abrams, Bull. N. Y. Bot. Gard. 6: 330. 1910, in part, as to the distribution in San Diego Co., Calif. Abrams' doubt as to the proper placement of this material is indicated when he states: "A small grove of cypress near the Jamul Valley, San Diego County, seems to belong to this insular species." 4). Rehd., in Bailey, Cult. Evergr. 209. 1923, in part, as to the distribution in southern California. 5). Abrams, Ill. Fl. Pac. States 1: 73. 1923, in part, as to the distribution in California. 6). Sarg., Man. Trees No. Am. 2nd ed. 73. 1926, in part, as to the distribution in California. 7). Sudw., U.S.D.A. Misc. Circ. 92: 37. 1927, in

FIGURE 30.

CUPRESSUS FORBESII—Tecate Cypress.
Slopes of Sierra Peak, Santa Ana Mts., Orange Co., Calif. Coll. No. 6278
(Prop. No. 2319). Tree 6-7 m. high. Photo Jan. 2, 1935. Neg. No. 3580.

FIGURE 31. *Cupressus Forbesii*. See opposite page.

part, as to the Mt. Tecate, San Diego Co., Calif. locality. 8). Van Dersal, Nat. Woody Pl. U. S. 115. 1938, in part. *C. Forbesii* Jepson is listed as a synonym.

CUPRESSUS MACROCARPA: Mast., Journ. Linn. Soc. **31**: 343. 1896, in part, as to the distribution: "San Diego, Palmer 460".

CUPRESSUS SARGENTII Jepson, Silva Calif. 158. 1910, in part, as to the distribution in San Diego Co., Calif. 2). Parish, Bull. South. Calif. Acad. Sci. **14**: 12. 1915. This is a report of a group of six trees growing about one mile south of the Lilac Schoolhouse, on a little-used road from Pala to Valley Center, San Diego Co., Calif. I have searched this locality on several occasions in an attempt to locate these trees but have thus far been unsuccessful. Parish's specimens (No. 9083, April 11, 1914) are vegetative branches and are in the Dudley Herbarium and the Jepson Herbarium. They could well be *C. macrocarpa* Hartw. 3). Sudw., U.S.D.A. Misc. Circ. **92**: 36. 1927, in part, as to the Cedar Canyon, San Diego Co., Calif. locality.

THE TECATE CYPRESS Parish, Bull. South. Calif. Acad. Sci. **13**: 11-13, pl. 1914. Parish discusses the distribution of cypress in San Diego Co., Calif. and points out that the plants have been referred to *C. Goweniana* (note spelling), *C. guadalupensis* and *C. Sargentii*. He thinks that the disposition under the latter species is most satisfactory. 2). C. F. Saunders, Bull. South. Calif. Acad. Sci. **15**: 18-21. pl. 1916. This is an account of the cypress trees on Mt. Tecate, San Diego Co., Calif. There is a photographic plate showing a small tree on the mountain. Nowhere in the article does Saunders state what species of *Cupressus* he believes these to be.

FIGURE 31.

CUPRESSUS FORBESII—Tecate Cypress.

A—Slopes of Sierra Peak, Santa Ana Mts., Orange Co., Calif. Coll. No. 6278 (*Prop. No. 2319*). Trunk showing smooth exfoliating, non-fibrous bark; the white card is 10 x 15 cm. Photo Jan. 2, 1935. Neg. No. 3583.

B—Mt. Tecate, San Diego Co., Calif. Coll. No. 6280 (*Prop. No. 2330*). A tree about 9 m. high, growing in a sheltered ravine. The loose, non-fibrous bark is readily lifted off disclosing the smooth, cherry-red surface beneath. The white card is 10 x 15 cm. Photo Jan. 16, 1935. Neg. No. 3593.

10. CUPRESSUS GUADALUPENSIS—Guadalupe Cypress*

Cupressus guadalupensis S. Wats., Proc. Am. Acad. 14: 300. 1879. A tree 15 to 20 m. high, usually with a broad, rounded crown when growing with sufficient space for full development; or, if crowded, with a rather narrow and sparse crown. Trunks often attaining a diam. of over 1.5 m., with a smooth, cherry-red or mahogany-brown bark that exfoliates annually in thin, non-fibrous curling plates; bark of the branches similar. In aspect, the trees vary from a slightly blue-green to a rich glaucous blue-green, especially on young trees. The young branchlets not at all harsh, but soft and slender, the ultimate branchlets often 20 to 30 mm. long, 1 to 1.5 mm. thick. Leaves at first rather acute, 1.5 to 2 mm. long, by 1.5 mm. wide, or on less vigorous shoots, somewhat shorter and more obtuse at apex; rounded or ridged on back, the darkened glandular pit usually non-functional or closed, but visible on most leaves, the fimbriate leaf margins easily visible with a low power lens. (10.5x). Leaves on vigorous shoots elongate and have a free end 2 to 4 mm. long, and may be over 10 mm. long over-all, but are of short duration and soon turn brown and are pushed off by the expanding bark of the branch beneath. Staminate cones rather large, often 6 mm. long, by 2 to 5 mm. thick, usually blunt at tip and base, the sides nearly cylindrical, or at least not conspicuously 4-sided, scales 10 to 18 or 20, but usually averaging about 16, the central ones usually bearing 5 pollen sacs. Ovulate cones produced on short, stubby branches with leaves well imbricated; during the first season the cones attain a diam. of over 1 cm. and have rather pronounced horns; at maturity the cones generally have 8 or 10 scales, often with conspicuous horns 5 to 6 mm. long, the entire cone usually 30 to 40 mm. in length, usually nearly as much in diam. (occasionally 50 mm. long); seeds usually well over 100 per cone, dark brown, 5 to 6 mm. long, irregularly shaped, with a rather thin wing, usually less than 1 mm. broad, surface with scattered warty pustules and usually slightly or conspicuously glaucous; hilum light brown 1 to 2 mm. long. In seedlings the leaves are often over 10 mm. long and are needle-like, with a minute spine or mucro at the tip. From the second to fourth year, the branchlets gradually produce the mature type of leaves, and both forms as well as the intermediate stages are present.

Type Locality

"On Guadalupe Island, off the coast of Lower California; distributed as *C. macrocarpa* in Dr. E. Palmer's collection from that island. In cultivation about San Francisco and likely to prove very

* Sometimes called Blue Cypress in cultivation in southern California, but this name is not distinctive since trees of the Smooth Arizona Cypress and this species are often somewhat similar in color while young.

valuable for ornamental purposes." S. Wats., Proc. Am. Acad. 14: 300. 1879.

Range

As far as is now known, this species is restricted in its distribution to Guadalupe Island off the coast of Baja California, Mexico. Reports of its occurrence elsewhere have been based on specimens of other species, namely *C. montana* of the Sierra San Pedro Martir of Baja California, and *C. Forbesii* of California and Baja California.

I have not been able to visit Guadalupe Island, but the following account by Edward W. Nelson (Lower California and Its Natural Resources, Mem. Nat. Acad. Sci. 16: 93-95. 1921) adds materially to our knowledge about the cypresses on the island and the conditions under which they grow. Accordingly, this is quoted here at some length.

"Guadalupe Island. Guadalupe is one of the largest and most notable islands lying off the coast of Lower California. It is situated 135 miles southwesterly from Point San Antonio, south of the mouth of Rosario River. It is roughly wedge-shaped and is nearly 22 miles long by 3 to 6 miles across, the broadest part lying to the north. The island forms a high unbroken volcanic ridge, highest in the northern part, where it reaches an altitude of over 4,500 feet above the sea. It is entirely surrounded by very deep water, which, 4 miles from the northern end, reaches a depth of 1,400 fathoms, and about the same distance from the southern extremity a depth of over 1,100 fathoms. Between the island and the mainland to the east is a great valleylike depression of the sea bottom having a depth of over 2,000 fathoms. This shows that the summit of Guadalupe is the crest of a gigantic mountain ridge rising over 16,500 feet above its base level on the sea bottom with only a little more than one-quarter of its height appearing above the surface of the sea. On the west the ridge of the island slopes rapidly toward the sea, ending in high cliffs. On this slope 2 great canyons lead down to the sea, separated by a barren hill of reddish rock. On the northern part of the island the ridge is very sharp and descends precipitously on the west, but slopes less rapidly on the east. There are several small elevated plateaus on this end of the island. The southern part is lower with more gradual descent and ends less abruptly. The surface of the island is covered with rough fragments of volcanic rock from the size of pebbles to huge, ragged outcropping boulders. The shore line is formed of perpendicular cliffs, which are extremely rough and precipitous, with many volcanic caves and holes which were formerly the favorable resorts of the Guadalupe fur seal.

"There are several springs on the northern plateaus but apparently no fresh water on the southern half of the island. Wood and water

may be found at a small cove near the north-eastern end.

"Guadalupe has the same wet and dry seasons as the California coast. Owing to its situation in the midst of cool ocean currents and the prevalence of the northwesterly winds, it is much cooler than any part of the coast of Lower California at the same altitudes. [Possibly should be latitudes, C. B. W.]. The winters are especially cool, owing to the cold sea winds and the prevalence of fogs; the summers are much dryer and comparatively very hot. Dense fogs are more abundant in winter but prevail also about higher parts of the island throughout most of the year. Dr. Edward Palmer reports that in December, 1874, ice formed an inch thick on the middle of the island accompanied by 2 inches of snow and hail and followed by five days of cold rain.

"During the winter of 1885-86, W. E. Bryant spent several months on the northern plateaus and experienced many cold rains and some frosts. During May and June, 1906, W. W. Brown explored the island and noticed that nearly every time there was a gale from the northwest it was accompanied by heavy fogs. He found the temperature so low that it was necessary to keep a roaring fire in camp, especially at night. For 10 days at a time the sun was hidden and everything was so saturated with moisture that it was difficult to preserve specimens. During the gales, when collecting in the open was impossible, Brown found that inside the cypress forest on the high tableland hardly a breath of air would be stirring so perfect was the protection of the heavy growth of these trees.

"At the time of his visit Brown found that the entire plateau of the southern half of the island was a sunburned waste with hardly a leaf of living verdure, but the higher and northern parts were more fertile and less dependent on rainfall, owing to the constant heavy fogs enveloping it. He discovered that the pines growing on the northern ridge of the island gave fine illustrations of the ability of trees to condense moisture from the air. These trees are on the summit of a precipice nearly 3,000 feet high facing the sea on the western side. When a strong wind brought in a fog, the ground under the pines streamed with water, which ran down the tree trunks, while the open ground some distance away was scarcely dampened. He adds that long ago, when the entire northwestern part of the island was covered with dense forest, the condensation must have been considerable, thus producing numerous springs and greatly benefiting the vegetation. Watson states that the low southern end of the island is warm and sunny, while the high northern end is covered by cold fog.

"Vegetation of Guadalupe—The Flora of Guadalupe is more closely related to that of California than to that of Lower California. More than 145 species of plants are known from the island, of which at least 29 are peculiar to it. The lower southern end of the island

is much warmer, drier, and more barren than the northern and entirely lacks trees. Watson (op. cit.) states that vegetation in the warm eastern canyons and on the southern end is two months ahead of the cold north and west parts. The higher northern end has scattered tracts of pines, cypresses, oaks, and palms.

"Unfortunately, the presence on Guadalupe of thousands of goats, which increase almost unchecked, has proved disastrous to the vegetation. Brown estimated that there were from 6,000 to 8,000 goats at the time of his visit in 1906, and states that the few plants that have escaped them are growing on perpendicular basaltic cliffs or are old trees with bark too hard and woody to eat. He did not find any young trees growing in the cypress, palm, and pine woods. The goats and house mice, which have also been introduced by man, eat the seeds as they fall, thus preventing the trees from reproducing themselves, and if present conditions continue the trees must become extinct. He noted that kids only a few months old were able to eat the hard palm seeds. Two species of trees are already extinct.

"At the northern end of the island Brown found the following conditions: A fast-decaying pine forest was growing along the narrow crest of the mountain at an altitude of about 3,000 feet and in some places down its almost perpendicular western slope. The ground was strewn with dead trees, goat trails winding among them in all directions. On the highest part of the island, north of Mount Augusta, a large cypress forest covers an area of about 3 square miles on the western slope, ending abruptly on the east at the crest of the ridge. Hundreds of cypress trees show the marks of goats' teeth and many were dead or dying. No living junipers were seen, but numerous dead stumps showed where a grove once existed. Far down the northwestern slope is a large grove of cabbage palms (*Erythea edulis*), and a small grove of the same exists near Steamer Point on the west shore. In the large palm grove mentioned above are some fine oak trees 30 to 65 feet high, and east of the cabins on the plateau under a cliff several oaks were growing, but they were stunted and low branching. In May and June vegetation consisted generally of wild oats and foxtail grass, but with a profusion of a species of *Malva* about old corrals. In the main cypress forest, on the high tableland, were numerous dead stumps of some species of shrub probably now extinct on the island.

"The original vegetation of Guadalupe has held its own only along the faces of bluffs and precipices which are inaccessible to the goats."

Collections:

a). *Franceschi*, winter of 1892-93 (Dudl. Herb., Pomona), some staminate cones with 20 scales; seeds glaucous; b). *A. W. Anthony* 12,

July-October, 1896. (Dudl. Herb., Pomona); c). G. D. Hanna, July 13, 1923 (Calif. Acad., Pomona). Staminate cones mostly with 16 scales, no ovulate cones; d). G. L. Fleming, August, 1931 (R.S.A.); e). J. T. Howell, March 17, 1932, the following nos.; 8297 (Calif. Acad., R. S. A., Dudl. Herb., Pomona, U.C.) from Mt. Augusta, trunk $19\frac{1}{2}$ ft. in circum. (over $5\frac{1}{2}$ ft. in diam.), 40 to 50 ft. tall, ovulate cones up to 50 mm. long, mostly with 8 scales, seeds very large, slightly glaucous. Leaves only slightly glaucous. Photographs taken by Mr. Howell and attached to the Rancho Santa Ana specimen, show an open park-like forest of large trees bordering a barren rocky plateau. Our *Prop.* No. 2068 was obtained from seeds supplied from this collection by Mr. Howell; 8298 (Calif. Acad.) Mt. Augusta, a form with small-horned cones, mostly 8 scales, leaves slightly glaucous, seeds glaucous; 8299 (Calif. Acad.) Mt. Augusta, form with very green, non-glaucous leaves, cones large mostly with 10 scales, horns inconspicuous, seeds lightly glaucous; 8300 (Calif. Acad.) very glaucous herbage, staminate cones with mostly 16 scales, but a few with only 12 scales, some ovulate cones over 40 mm. long, with 8 scales, seeds glaucous; 8301 (Calif. Acad.) well laden with young ovulate cones, mature cones furrowed, with 8 or 10 scales, these very glaucous on inner faces; 8302 (Calif. Acad.) foliage rather green, ovulate cones with 8 scales and large horns, the inner faces of the scales very glaucous, seeds only lightly glaucous; 8303 (Calif. Acad.) herbage moderately glaucous, largest cones about 45 mm. long, with large horns, 10 scales, the inner faces very glaucous, seeds almost non-glaucous.

Collections of Cultivated Specimens

C. B. Wolf, *Coll. No.* 11,288, July 29, 1942, from trees of *Prop.* No. 2069 cultivated at S. W. corner of Botanic Garden; seeds planted in seed flat April 11, 1933; young plants set out in Garden March 12, 1934; at the time of this collection, these trees were 5-6 m. high, were considerably greener foliated than many cultivated specimens in California (which are often very blue-glaucous), and although about 9 years old from seed, some of the trees still had branches near the base bearing juvenile foliage; the present specimen illustrates the transitional leaf form from juvenile to mature on a branch 20 cm. in length. The dorsal pits present on some of the mature type leaves are inactive and no more conspicuous than in *C. macrocarpa*.

Relationships

Cupressus guadalupensis is most closely related to *C. Forbesii*, a species restricted to a few areas of southern California and Baja California. The two species are alike in that they both have smooth, cherry-red or mahogany-brown, exfoliating bark on their

trunks and branches; that they generally develop a branched crown instead of retaining a single central axis; and that the dorsal glands of the leaves when visible, are usually inconspicuous and are rarely, if ever, active. *C. guadalupensis* is a larger tree in the wild as well as in cultivation, usually has bluish-green or glaucous blue-green instead of green foliage; it also has staminate cones with 14 to 18 scales, whereas, in *C. Forbesii* there are usually 10 to 14 scales. Seeds of *C. guadalupensis* are usually glaucous, and the inner faces of the cone scales are also glaucous, whereas, in *C. Forbesii* they are not glaucous. Ovulate cones of *C. guadalupensis* are generally larger, attaining a maximum size of about 45 mm., whereas, in *C. Forbesii* they are rarely over 30 mm. long.

I do not believe that the cherry-red, exfoliating bark of *C. guadalupensis* and *C. Forbesii* indicates a close relationship with species such as *C. arizonica*, *C. nevadensis*, *C. Bakeri*, and *C. Stephensonii*, but is merely a parallel development, for these species are essentially gray-foliaged and have active dorsal leaf glands. A more plausible conclusion is that *C. guadalupensis* and *C. Forbesii* represent an offshoot from the stock which gave rise to the *C. macrocarpa* group of species.

References

- CUPRESSUS GUADALUPENSIS S. Wats., Proc. Am. Acad. 14: 300. 1879. Original description, see quotation under Type Locality in text. 2). Lemm., West. Am. Conebearers 3rd ed. 76. 1895, in part, as to the Guadalupe Island reference. 3). Lemm., Sierra Club Bull. 4: 116. 1902, in part, as to the Guadalupe Island reference. 4). Brit., Trees of No. Am. 102. 1908. Britton mentions *C. guadalupensis* S. Wats. as a species of Baja California that has been confused with *C. arizonica* Greene. If he meant Guadalupe Island, then his reference is correct, but if he meant the mainland of Baja California, it is possible that his plants were either *C. Forbesii* or *C. montana* or both. 5). Abrams, Bull. N. Y. Bot. Gard. 6: 330. 1910, in part, as to the reference to Guadalupe Island. 6). Standl., Contrib. U.S. Nat. Herb. 23: 62. 1920. Standley limits the distribution of this species to Guadalupe Island and states that one tree measured by Palmer had a trunk 2 meters in circumference with 236 annual rings. 7). Nelson, Mem. Nat. Acad. Sci. 16: 95. 1921. In discussing the life zones of Guadalupe Island, Nelson states that *Pinus radiata* and *Cupressus guadalupensis* are the main trees of the Transition Zone. 8). Nelson, Mem. Nat. Acad. Sci. 16: 105. 1921. According to Nelson, there is a large cypress forest (*Cupressus guadalupensis*) on the highest part of Guadalupe Island, north of Mount Augusta. 9). Abrams, Ill. Fl. Pac. States 1: 73. 1923, in part, as to the reference to Guadalupe Island. 10). Rehd., in Bailey, Cult. Evergr. 209. 1925,

in part, as to the reference to Guadalupe Island. 11). Sarg., Man. Trees No. Am. 2nd ed. 73. 1926, in part, as to the Guadalupe Island reference only. 12). Sudw., U.S.D.A. Misc. Circ. 92: 37. 1927, in part, as to the Guadalupe Island reference. 13). Wiggins, Contrib. Dudl. Herb. 1: 162-163. 1933. In discussing *C. montana*, Wiggins contrasts it with *C. guadalupensis*, with which it has been confused. 14). Van Dersal, Nat. Woody Pl. U. S. 115. 1938, in part. *C. Forbesii* Jepson is listed as a synonym. 15). Howell, Leafl. West. Bot. 3: 145-146. 1942. In this list of the vascular plants of Guadalupe Island, Howell discusses the cypresses at some length. The large trunk mentioned is shown in my text, and the several botanical collections cited are also discussed in my text. He says in part: "No small trees were seen; seedlings with only their tiny seed-leaves were numerous but unfortunately they will furnish the goats with a wee bit of green pasture in the summer."

CUPRESSUS MACROCARPA var. GUADALUPENSIS Mast., Gard. Chron. III, 18: 62. Figs. 8, 9, 12. 1895. In making this new combination, Masters failed to detect the significant differences between *C. macrocarpa* and *C. guadalupensis* as shown by his statement: "the present is but an insular variety of the species, differing from the type more especially in its glaucous colour." 2). Mast., Journ. Linn. Soc. 31: 343. 1896. Masters restricts the var. *guadalupensis* to Guadalupe Island and cites specimens as follows: Palmer 92, Franceschi. 3). Elwes & Henry, Trees of Great Brit. & Irel. 5: 1165. 1910. These authors followed Masters in treating *C. guadalupensis* as a variety of *C. macrocarpa*. 4). Camus, Les Cypres 35. 1914. 5). Dalli. & Jacks., Handb. Conif. 210. 1923.

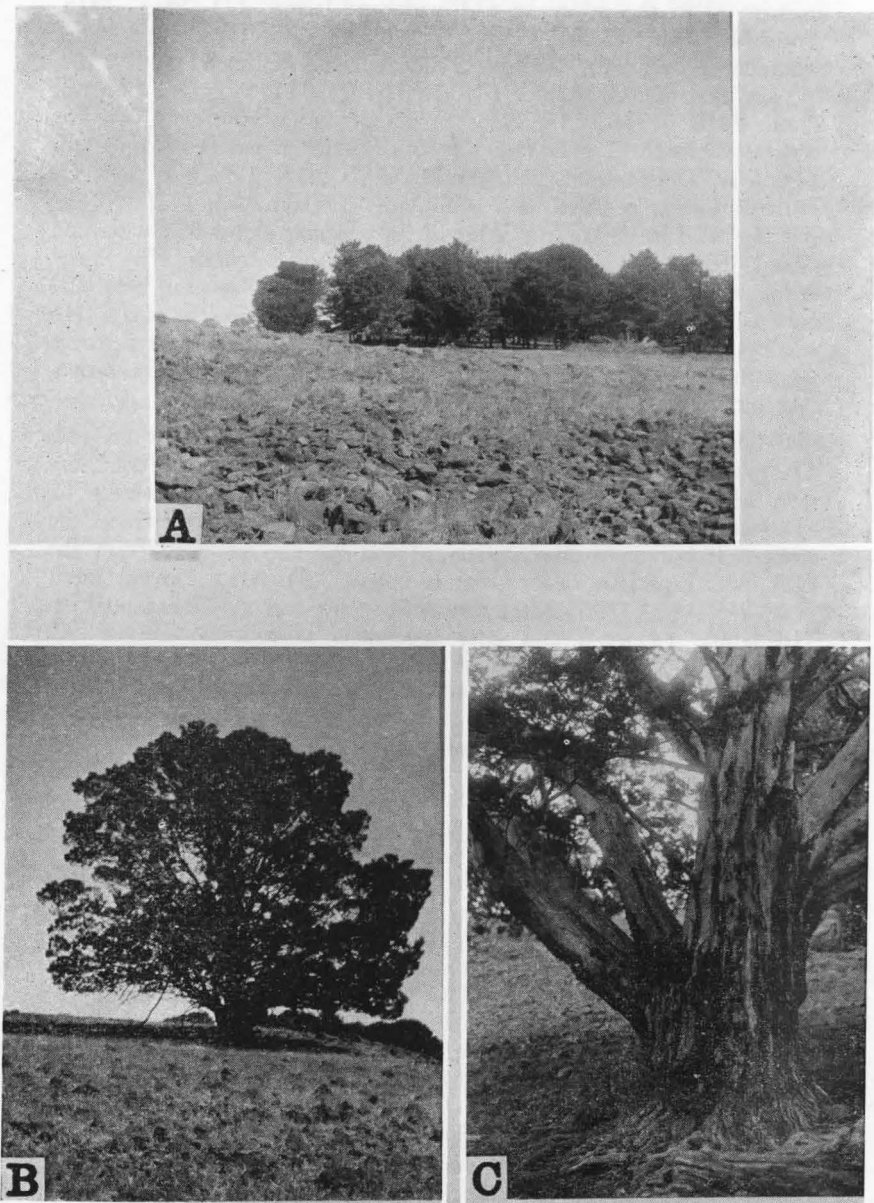


FIGURE 32. *Cupressus guadalupensis*.

11. *CUPRESSUS MACROCARPA*—Monterey Cypress

Cupressus macrocarpa Hartw., ex Gord., Journ. Hort. Soc. Lond. 2: 187. 1847. Tree attaining a height of 20 to 25 m., but of very diverse habit when young or in sheltered spots as compared with old trees on exposed headlands. Young trees erect with a straight central trunk and symmetrical branching and a slender leader. A typical tree of this sort from a sheltered spot on Point Lobos was 22 m. high, 12 m. spread and a trunk 6 dm. in diam. at 1 m. above ground; another from Point Cypress and also in a sheltered spot was 14 m. high, 10 m. in spread and had a trunk 3 dm. in diam. at 1 m. Young trees 4 or 5 m. high have a slender leader with sparse and irregular branches which point upward at an acute angle, spread at a right angle, or are even deflexed. In later years the trunk becomes massive, is frequently branched near the ground and the broad, round-topped crown greatly exceeds the height. In extreme maturity the foliage from many of the lower branches is lost, and the tree becomes picturesque with an irregular flat top and very massive trunks and main limbs covered with a thick fibrous, ashy-gray bark, which is frequently heavily burdened with lichens. A typical massive tree of this sort at Point Lobos was 17 to 18 m. high, 17 to 18 m. in spread and had a trunk 1.7 m. in diam. and at its smallest point between the basal bulge and the main branching. At Point Cypress a somewhat younger and still vigorous tree had a height of 10 m., was 10 m. in spread, and had a trunk 1.3 m. in diam., but which branched into several massive branches at about 1 m. above ground. This tree formed a dense umbrella-like canopy with several of the branches nearly touching the ground. Nearby another tree was 18 to 20 m. high, slightly less in spread and had a sparse crown and 3 main trunks each of which was about 6 dm. in diam. Bark of the branches is a rich brown at first and on vigorous trees does not become ashy-gray until the diam. is 2 or more dm., whereas, on old slow growing trees the ashy-gray bark is developed on much smaller branches. In aspect, the trees are a rich bright green, although some of the old trees sometimes appear a little dull. Under no conditions does the foliage ever have a bluish or glaucous aspect, nor is it ever a truly dull green. Perhaps, the dull green mentioned above is due to the accumulation of dust upon the foliage during the summer months, and which mainly is washed off during the winter. Branchlets of the season 8 to 15 mm. long, less than 2 mm. in diam. and are

FIGURE 32.

CUPRESSUS GUADALUPENSIS—Guadalupe Cypress.
 A—Trees on Mt. Augusta, Guadalupe Island, Mexico.
 B—Single large tree on Mt. Augusta, Guadalupe Island, Mexico. Photos taken in 1923 by J. R. Slevin.
 C—Trunk of tree on Guadalupe Island, Mexico, 1.67 m. in diam. at point below branching. For details of this tree, see Leaflet West. Bot. 3: 145, 1932. Photo 1932 by J. T. Howell. All 3 photos from the collections of the California Academy of Sciences, courtesy of J. T. Howell.

irregularly disposed on all sides of the branches. The leaves are a little less than 2 mm. long, acutely but bluntly pointed and closely appressed. Some but not all of these leaves show a faint darker and slightly depressed spot on the back which is a strictly inactive gland. On vigorous shoots the leaves elongate to 5 or 10 mm. in length, become 3 or 4 mm. wide and have a widely spreading and acutely pointed tip. These leaves soon turn brown and are pushed off by the expanding bark of the branch beneath. On old or mature trees, the growth is very different with the ultimate branchlets often less than 5 mm. long and 2 to 3 mm. thick, with leaves frequently only 1 mm. long and closely imbricated, giving the branchlets a distinctly 4-sided appearance; on such trees the elongated leaves are rarely over 5 mm. long, are 3 to 3.5 mm. broad, and have a much less conspicuously spreading tip. Staminate cones produced in profusion at the tips of short branchlets; cones 6 mm. long, 2.5 to 3 mm. in diam., obscurely 4-sided, consisting of 12 to 14 scales, these 2.5 to 3 mm. broad, their margins slightly fimbriate; each scale bears 6 to 8 or even as many as 10 pollen sacs, the upper and lower scales usually with only 6 sacs. Due to the high number of pollen sacs, some scales have essentially 2 irregular rows of sacs across the lower half. The staminate cones are at first bright green, then turn brown after the pollen is shed, and the cone falls off in a few months. Ovulate cones are solitary at the ends of short branchlets, but these are usually aggregated in clusters of which sometimes a dozen or so develop to maturity. Ovulate cones at first apparent as slightly thickened tips on the short branchlets; soon the 8 to 12 scales spread apart and disclose the numerous ovules; after pollination the scales close, and by the end of the first season, they are often 10 to 15 mm. in diam., of regular or irregular shape with the fused margins of the scales somewhat raised and the umbos conspicuous as broad curved structures about 2 mm. high. During the second season, the surface of the cones changes from green to brown, the tissue fills out, the umbos become much less conspicuous; and, in general, the cones are globose or slightly longer than thick, and are from 25 to 35 mm. long; there is a great variation in the size of the mature cone scales; the basal pair may be less than 5 mm. broad, while the next 2 pairs may be over 20 mm. broad, and the terminal pair is often greatly suppressed by crowding, and only the umbos are visible as conical projections about 2 to 4 mm. high. Seeds dark brown, irregular in outline, but are frequently 5 to 6 mm. long, equally broad and 2 or 3 mm. thick, with a rather prominent wing-like margin 1 or 2 mm. wide, and a conspicuous whitish hilum 1.5 to 2.5 mm. long. The usual cone has about 140 seeds. The cones remain closed for several years and generally are drilled by insects and many of the seeds eaten long before they open from extreme age. Very old cones lose their brown color and become a dull gray. Cotyledons usually 4, but sometimes

3 or 5; in germination they become 10 to 12 mm. long, are slightly flattened, but linear and with a blunt tip (terete near tip). The next leaves are similar but shorter, and have an acute needle-like tip, and arise in whorls of 3 or 4. These needle-like leaves persist for the first and second years after which transitional types approaching those of the mature type are formed; and, eventually, only mature type leaves are produced.

Type Locality

"Crossing the wooded heights near Monterey I arrived at Carmel Bay, after an easy walk of two hours, here I found *Diervalla*, No. 47; *Cupressus macrocarpa*, No. 143, attaining a height of 60 feet, and a stem of 9 feet in circumference, with far-spreading branches, flat at the top like a full-grown Cedar of Lebanon, which it closely resembles at a distance." Hartw., ex Gord., Journ. Hort. Soc. Lond. 2: 187. 1847. This certainly refers to the Point Cypress grove. Collected by Karl T. Hartweg in 1846. Type specimen probably in Kew Herbarium.

It is strange that none of the earlier collectors who visited Monterey seems to have learned of the Monterey Cypress. Among these may be mentioned Menzies, Douglas and Nuttall. Perhaps they collected specimens which have been lost or misplaced.

Range

United States. California. Monterey County. Known only from two localities on the shores of Monterey County: The original station being at Point Cypress along the famous Seventeen Mile Drive between Pacific Grove and Carmel, and the other at Point Lobos which forms the southern boundary of Carmel Bay. Both of these groves are on the immediate seacoast, and many of the trees are subjected to considerable salt spray. A green alga (*Trentepolia*) covers many of the branches of these trees and because of its orange-red color is conspicuous. Probably none of the trees at Point Cypress is more than one-half a mile from the ocean, while at Point Lobos they are even closer to the ocean. The soils of both localities appear to be of granitic origin and are considerably richer than those inland a short distance where the stands of *Cupressus Goveniana* grow. Both groves have numerous trees of *Pinus radiata* in their immediate vicinity and are, perhaps, being crowded out by that aggressive species.

The trees of *Cupressus macrocarpa* are of two main sorts, depending on their location. Those on the exposed headlands where the winds and salt spray hit them are rugged and crooked and have massive irregular trunks, flat tops and, in general, show their fight

for existence. Inland a short distance and away from the wind, the trees develop into tall and symmetrical individuals and have a slender leader. These latter trees match very well the typical large tree of this species seen in cultivation away from the coast.

Photographers and artists have long recognized the picturesque features of many of the Monterey Cypresses on the rugged points of land at Point Cypress and Point Lobos. As a result, scenes depicting these trees are frequently found in California homes and probably elsewhere. Thus, to thousands of people who have never been to the Monterey coast, the Monterey Cypresses are well known.

The Point Lobos grove of cypress is now a part of the California State Park System, and every means is being taken to insure its perpetuation. The nominal charge for visitors and the limited roads in the area are effective means of giving the trees ample opportunity to thrive.

For many years Mr. R. A. Wilson has been Custodian of the Point Lobos Preserve and has a deep love of and appreciation for every Monterey Cypress in the area. Under his watchful eye, the large trees are being adequately protected, and the occasional young seedlings are given every encouragement to grow up as eventual replacements for the venerable monarchs, some of which must eventually die.

Although I have been to the native groves of Monterey Cypresses many times, I have never studied them with the same thoroughness as many others have done. For this reason, I believe that the following article entitled "Historical Note on the Monterey Cypress at Cypress Point" by Harry Ashland Green (*Madroño* 1: 197-198. 1929) is worth quoting in its entirety:

"In the Cypress Grove, at Cypress Point, Monterey, there are 10,550 cypress trees, including those growing along the 'Seventeen Mile Drive' strip between the main grove and Pebble Beach, which property is being sold for residence purposes. Leaving out the strip mentioned, the grove occupies about 50 acres. To arrive at the number of trees I divided the territory into seven sections, counting each separately. There are 2700 cypresses fringing the shore eastward from the main grove, in the strip referred to, thus leaving 7,850 trees in the 50 acres, other than saplings. Throughout the territory are surveyor's stakes and a new road has been built eastward through the grove. At a point where the cypresses terminate somewhat abruptly some clearing has been done. Many years ago I urged that the pines be cleared away there and back into the grove. It is now evident that, had this been done, there would be many more cypress trees in that area than there are now. Our short-lived tolerant pines have not only choked out the young cypresses but the mature ones have destroyed many cypress trees in falling, even large ones.

"I have a personal acquaintance with all the cypress trees in the grove having any right to claim distinction. Some of them I have known for nearly forty years, particularly one which I named Octopus. I am willing to believe that this most distorted of all trees on earth is 1,000 years old, and that there are older ones in the grove. A tree sawn off at the ground many years ago is still lying sound and looks as if it might have lived 10,000 years; on counting its rings only 184 were found.

"I wanted to believe that there are cypresses in our grove at least as old as the Christian Era, but my conscience forced me to join the ranks of the conservatives. Of course such persons are quite unpopular in this region and the tourist is regularly furnished with one or the other most wonderful stories of how and when the grove was planted by man. The age of the oldest trees is given to travelers as from four to eight thousand years.

"A number of old trees, back among the pines, have been hollowed by fire. One hollowed tree is about 70 feet high and measures 18 feet, 8 inches in circumference breast high. It is still in fair condition. Another cypress, growing about 1,000 feet from the ocean shore and which shows no mark of fire, has a girth, breast high, 15 feet, 4 inches with a spread of 90 feet in one direction and 75 feet in the other. At the ground, including the roots, the tape measure showed 34 feet as its circumference.

"When we were trying to have the Cypress Point grove made into a National Monument its land value was deemed insignificant; at the present time villa sites, with shore frontage, are held at ten thousand dollars per acre. Monterey, November 16, 1921."

Collections from Point Cypress:

a). J. T. Howell, Coll. No. 662 (*Prop. No. 239*), August 19, 1927; b). C. B. Wolf, Coll. No. 2322 (*Prop. No. 1191*), August 17, 1931, from a tree 10 m. high, 10 m. spread, and a trunk 1.3 m. in diam.; c). C. B. Wolf, Coll. No. 6233 (*Prop. No. 2184*, our Point Cypress Strain), November 8, 1934, from a tree 14 m. high, 10 m. spread and a trunk 3 dm. in diam.; this was a straight tree located about 1/8 mile inland and away from the strong ocean winds.

Collections from Point Lobos:

a). C. B. Wolf, Coll. No. 2321 (*Prop. No. 1190*), August 17, 1931, from a tree on exposed bluffs, 10 m. high, 10 m. spread and a trunk about 1 m. in diam. This tree had not reached old over-age maturity and still had a dense rounded crown of foliage. b). C. B. Wolf, Coll. No. 6227 (*Prop. No. 2177*, our Point Lobos No. 1 Strain), November 7, 1934, from a tall erect tree in a sheltered spot, 21 to 22 m. high, 11 to 12 m. spread and a trunk over 5 dm. in diam. at 1 m. c). C. B. Wolf, Coll. No. 6228 (*Prop. No. 2178*,

our Point Lobos No. 2 Strain), November 7, 1934, from a tree in the north grove of Point Lobos and close to the ocean, 17 to 18 m. high, 17 to 18 m. spread and a trunk 1.6 m. in diam. at the smallest point between the basal bulge and the main crotch.

Collections of Cultivated Specimens

a). C. B. Wolf, Coll. No. 4192, August 19, 1932, seedlings of *Prop. No. 1190*, from a Garden outside seed bed planted January 20, 1932; 5, 12, 15 and 17 cm. high, with juvenile spreading leaves, cotyledons still present; these seedlings had never been transplanted and some had taproots over 20 cm. long and a few lateral roots. b). C. B. Wolf, Coll. No. 4193, August 19, 1932, seedlings of *Prop. No. 1191*, from a Garden outside seed bed planted January 20, 1932; 4-9 cm. high, with juvenile spreading leaves, cotyledons still present; these seedlings had never been transplanted, and some had taproots over 15 cm. long, with few lateral roots. c). P. C. Everett, Coll. No. 7800, May 19, 1936, seedlings of *Prop. No. 2177*, from 4 in. pots in Garden nursery, seed flats planted March 28, 1935; 23 and 28 cm. high; with juvenile spreading leaves; root system extensive, but one of seedlings with a "coiled" taproot, which clearly demonstrates difficulty of growing good plants of this genus in small pots. d). P. C. Everett, Coll. No. 7801, May 19, 1936, seedlings of *Prop. No. 2178*, from 4 in. pots in Garden nursery, seed flat planted March 28, 1935; 19 and 23 cm. high, with juvenile spreading leaves, a rather pronounced central axis and well developed root system. e). P. C. Everett, Coll. No. 7806, May 19, 1936, seedlings of *Prop. No. 2184*, from 4 in. pots in Garden nursery, seed flat planted March 28, 1935; 28 and 31 cm. high, with strictly juvenile spreading leaves, a rather pronounced central axis and root system fairly well developed, but in both seedlings the taproot is partially coiled, demonstrating the difficulty of growing good plants of this genus in small pots.

Relationships

Cupressus macrocarpa is the outstanding large-sized member of the group of species which includes *C. Abramsiana*, *C. Goveniana* and *C. pygmaea*. However, its features are so distinctive that it has never been confused with any of these species. From all of these it is distinguished by its much larger cones and generally much larger seeds. In growth habit the larger trees of *C. pygmaea* are most like *C. macrocarpa*, but no trees of the former species are known to have broad spreading crowns. The branchlets of *C. macrocarpa* are much thicker than any of the other three species.

The species to which *C. macrocarpa* bears a close resemblance is *C. sempervirens* of the Mediterranean region, and under cultivation

in California its broad form is often confused with our native cypress. It has been suggested many times that these two species have hybridized, and that many of the "off-type" cultivated trees of *C. sempervirens* are the result of the hybridization, but I am not convinced that this is so.

References

CUPRESSUS MACROCARPA Hartw. ex Gord., Journ. Hort. Soc. Lond. 2: 187. 1847. "Crossing the wooded heights near Monterey I arrived at Carmel Bay, after an easy walk of two hours, here I found *Diervalla*, No. 47; *Cupressus macrocarpa*, No. 143, attaining the height of 60 feet, and a stem of 9 feet in circumference, with far-spreading branches, flat at top like a full-grown Cedar of Lebanon, which it closely resembles at a distance." This is an excerpt from Hartweg's journal which Gordon published in the Journal of the Horticultural Society of London. The Index Kewensis cites this reference as the place of original publication for *Cupressus macrocarpa*. The description of the species is certainly not technical and would not be acceptable today, yet it more accurately places the species than many other descriptions which are accepted without question. For additional discussion, consult the following literature citation. 2). Gord., Journ. Hort. Soc. Lond. 4: 296. 1849. *Cupressus Lambertiana* of the gardens is listed as a synonym; and, as here pointed out, was never properly published; and, therefore, *C. macrocarpa* takes precedence. This is the reference often listed as the original description of *C. macrocarpa*, yet Gordon regarded Hartweg's earlier account as valid and was merely describing the plant in greater detail. Furthermore, the 1847 reference in the Journ. Hort. Soc. Lond. is the one cited in the Index Kewensis. The figure on p. 279 is titled "*Cupressus Lambertiana*" and shows three large cones and a fragment of branches. 3). Gord. & Glend., Pinet. 65. 1858. *C. Lambertiana* Gord. and *C. macrocarpa fastigiata* Knight are listed as synonyms. According to this account, the late Mr. Lambert distributed seeds in 1838 which Gordon called *C. Lambertiana* but did not publish. Some two years later, he observed it at Mr. Low's nursery at Clapton, where it had been grown from seeds received from Dr. Fischer, of St. Petersburg, as a new species from California. He further states that *C. macrocarpa* Hartw. is identical and because properly published takes precedence over *C. Lambertiana*, although the latter name was in general use. 4). Parl., in DC. Prod. 16: 473. 1864. Variety *fastigiata* Hcrt. is recognized. It is also of interest to note that *C. macrocarpa* Hartw. is recognized in preference to *C. Lambertiana*. 5). Engelm., in Brew. & Wats., Bot. Calif. 2: 113. 1880. *C. Lambertiana* Gord. and *C. Hartwegii* Carr. are recognized as synonyms. "The largest measurements recorded (by Prof. W. H. Brewer) is a circumference of 18 2/3 feet at a

height of 5 or 6 feet from the ground." 6). Lemm., West. Am. Conebearers 3rd ed. 76. 1895. 7). Sarg., Silva No. Am. 11: 103. Tab. DXXV. 1896. 8). Mast. Journ. Linn. Soc. 31: 343. 1896, in part. *C. Lambertiana* Carr., *C. Hartwegii* Carr., *C. torulosa* Lindl. and Paxt., and *C. Reinwardtii* Hort. are listed as synonyms. New varietal forms which are recognized by Masters are: var. *Lambertiana*, var. *farallonensis*, and var. *Crippsii*. Masters states that Prof. Greene had told him that the Farallones "are little better than barren rocks and only with difficulty accessible". Nevertheless, Masters apparently preferred to believe that the University of California gardener had sent him seeds of a cypress which grew on the Farallones, and so described the plants he grew as a new variety. 9). Jepson, Fl. West. Middle Calif. 26. 1901. 10). Lemm., Sierra Club Bull. 4: 113, 1902. 11). Sudw., For. Trees Pac. Slope 158. Fig. 61. 1908. Sudworth states that this species grows "mainly in pure, more or less dense stand, but mingled on the east with Monterey pine and occasional Gowen cypress". This statement may have been true prior to 1908, but my observations on the two native groves of Monterey Cypress are that in neither one do trees intermingle with those of the Gowen Cypress. 12). Brit., No. Am. Trees 98. Fig. 73. 1908. *C. Hartwegii* Carr. is listed as a synonym. According to Britton, the wood has a specific gravity of about 0.63. 13). Jepson, Fl. Calif. 1: 60. 1909. 14). Beissn., Handb. Nadelh. 2: 579. 1909. *C. Lambertiana* Carr., *C. Hartwegii* Carr., and *C. Reinwardtii* Hort. are recognized as synonyms. 15). Elwes & Henry, Trees of Great Brit. & Irel. 5: 1165. 1910, in part. *C. Lambertiana* Carr., *C. Hartwegii* Carr., *C. guadalupensis*, *C. torulosa* Lindl. not Don, and *C. Reinwardtii* Beissn. are listed as synonyms. The following varieties are recognized: var. *guadalupensis* Mast., var. *fastigiata* Mast., var. *Lambertiana* Mast., var. *Crippsii* Gord. Pinet. 93. 1875, var. *lutea* Kent, Veitch's Man. Conif. 215. 1900, var. *variegata*, and var. *farallonensis* Mast. 16). Jepson Silva Calif. pp. 155-158. 1910. 17). Camus, Les Cyprès 35. 1914. Varieties *fastigiata* Knight & Perry and *Lambertiana* Mast. are recognized. 18). Abrams, Ill. Fl. Pac. States 1: 72. Fig. 149. 1923. *C. Hartwegii* Carr. is listed as a synonym. 19). Jepson, Man. Fl. Pl. Calif. 57. Fig. 49. 1923. 20). Dalli. & Jacks., Handb. Conif. 207. Fig. 42. 1923. *C. Hartwegii* Carr. and *C. Reinwardtii* Beissn. are listed as synonyms. These authors claim that var. *fastigiata* Mast. and var. *Lambertiana* Mast. have both been grown from seeds from the same tree. They also mention the following varieties as having originated in cultivation: var. *Crippsii* Gord. which "was raised from imported seed in the Tunbridge Wells nursery of the late Thomas Cripps about the middle of the last century"; var. *farallonensis* Mast. "a curious form reported to exist on the Farallones Islands near San Francisco, but which really appears to have arisen as a sport in the California University garden"; var. *flagelliformis* Cripps, said to have

been grown by Cripps in 1875; var. *lutea*, "this handsome form was distributed by Messrs Dicksons of Chester in 1895, it having originated in their nursery a few years earlier"; var. *variegata* Lemaire, "young leaves blotched with white, not very attractive, and rarely met with in cultivation". 21). Rehd., in Bailey, St. Cycl. Hort. 1: 915. 1925. *C. Hartwegii* Carr. is listed as a synonym. Vars. *Crippsii* Mast., *fastigiata* Knight, *Lambertiana* Mast., and *lutea* Hort. are recognized. 22). Rehd., in Bailey, Cult. Evergr. 208. 1925. *C. Hartwegii* Carr. and *C. Lambertiana* Gord. are listed as synonyms. Rehder says the species was introduced to Europe in 1838. 23). Sarg., Trees No. Am. 2nd ed. 70. Fig 68. 1926. Sargent apparently decided that Gordon was the author of this species rather than Hartweg and must have based his opinion on the emended description supplied by Gordon in the Journ. Hort. Soc. Lond. 4: 296. 1849. 24). Rehd., Man. Cult. Trees & Shrubs 16. 1927. *C. Lambertiana* is listed as a synonym. This species is said by Rehder to have been introduced into cultivation in 1838. 25). Sudw., U.S.D.A. Misc. Circ. 92: 36. 1927. Sudworth states that the following varieties are distinguished in cultivation: *angulata* Lemm., *Lambertiana* (Carr.) Mast., and *Crippsii* Mast. 26). H. A. Greene, Madroño 1: 197-198. 1929. This is an historical note on the Monterey Cypress at Cypress Point and is discussed in the text. 27). Munz, Man. Bot. South. Calif. 18. 1935. This species is given incidental mention as a native of central California and as a common plant in cultivation. 28). Van Dersal, Nat. Woody Pl. U.S. 115. 1938. Said by this author to be "free from insects and most diseases". However, at the time that was published, the major plantings of this species in California had already died from Cypress Canker. 29). Rehd., Man. Cult. Trees & Shrubs ed. 2. 55. 1940. *C. Lambertiana* Gord. is listed as a synonym. Also note that Rehder now regards Gordon as the author of this species, although his previously cited works accepted Hartweg.

CUPRESSUS MACROCARPA var. *ANGULATA* Lemm., Sierra Club Bull. 4: 115. 1902. "Is distinguished by having the scales numerous, ten to sixteen in an elongated cone, giving the cone a many-sided hexagonal form, if composed of six pairs of scales, or polyhedral, if containing more scales." This is strictly a garden form, probably observed by Lemmon around Berkeley, California.

CUPRESSUS MACROCARPA var. *CRIPPSII* R. Smith, Pl. Fir Tribe 16. [1874]. "An interesting variety similar to the species in style of growth, but differing from it in the beautiful silver white variegation of the foliage." This is from a commercial catalogue. 2). Gord. & Glend., Pinet. ed. 3. 93. 1875. 3). Mast., Journ. Linn. Soc. 31: 343. 1896. 4). Elwes & Henry, Trees of Great Brit. & Irel. 5: 1165. 1910. This variety is credited to Gord., Pinet. ed. 3. 93. 1875. 5). Rehd., in Bailey, Cult. Evergr. 209. 1925. "A juvenile form with rigid

short branchlets and spreading sharp-pointed leaves; the tips of young branches silvery-white." 6). Rehd., *Man. Cult. Trees & Shrubs* 16. 1927. "A juvenile form with stiff brs. and spreading subulate lvs." 7). Rehd., *Man. Cult. Trees & Shrubs* ed. 2. 56. 1940. "A juvenile form with stiff brs. and spreading subulate lvs."

CUPRESSUS MACROCARPA var. *FARALLONENSIS* Mast., *Journ. Linn. Soc.* 31: 343. 1896. For discussion of this variety, see note under *C. macrocarpa* by Mast., 1896. 2). Elwes & Henry, *Trees of Great Brit & Irel.* 5: 1165. 1910.

CUPRESSUS MACROCARPA FASTIGIATA Carr., in Ducharte, Carrière & Nandig, *Man. Gen. Pl. Arbr. et Arbustres* 4: 326. 1857. This is a garden variety. 2). Parl., in DC. *Prod.* 16: 473. 1864. This variety is regarded as having originated in horticulture. 3). Elwes & Henry, *Trees of Great Brit. & Irel.* 5: 1165. 1910. 4). Rehd., in Bailey, *Cult. Evergr.* 208. 1925. "Branches ascending, forming a compact fastigiate head." 5). Rehd., *Man. Cult. Trees & Shrubs* 16. 1927. "Brs. ascending forming a dense fastigiate head." 6). Rehd., *Man. Cult. Trees & Shrubs* ed. 2. 56. 1940. "Brs. ascending forming a dense fastigiate head."

CUPRESSUS MACROCARPA var. *LAMBERTIANA* Mast., *Journ. Linn. Soc.* 31: 343. 1896. This new variety is based on *C. Lambertiana* Carr. 2). Elwes & Henry, *Trees of Great Brit. & Irel.* 5: 1165. 1910.

CUPRESSUS MACROCARPA var. *LUTEA* Kent, Veitch's *Man. Conif.* 215. 1900. 2). Elwes & Henry, *Trees of Great Brit. & Irel.* 5: 1165. 1910. 3). Rehd., in Bailey, *Cult. Evergr.* 208. 1925. "An upright, fastigiate form with yellow foliage changing to green the second year." It is here called "Yellow Macnab C.", but this is certainly a printer's error. 4). Rehd., *Man. Cult. Trees & Shrubs* 16. 1927. "Narrow pyramidal form with yellow lvs." 5). Rehd., *Man. Cult. Trees & Shrubs* ed. 2. 56. 1940. "Narrow pyramidal form with yellow lvs."

CUPRESSUS MACROCARPA PYGMAEA A. B. Jacks., *Gard. Chron.* 3rd. Ser. 103. Fig. 105. 1938. "A New Dwarf Conifer. The well-known Monterey Cypress (*Cupressus macrocarpa*) has lately given rise, in cultivation, to an interesting dwarf mutation the history of which is as follows:—About 1929, a quantity of seeds obtained from cones of a typical tree of *Cupressus macrocarpa* were sown by the late Mr. Marcham in his nursery at Carshalton, Surrey, and among the thousand seedlings raised the pigmy form here illustrated (Fig. 105) appeared in the bed. Although now about nine years old, it still maintains its dwarf habit being only about four inches high by six inches in diameter. This is not surprising, however, as when dwarf Conifers originate in the seed bed, as they often do, they usually retain their habit irrespective of age. I have looked up all the recent literature on Conifers but can find no reference to

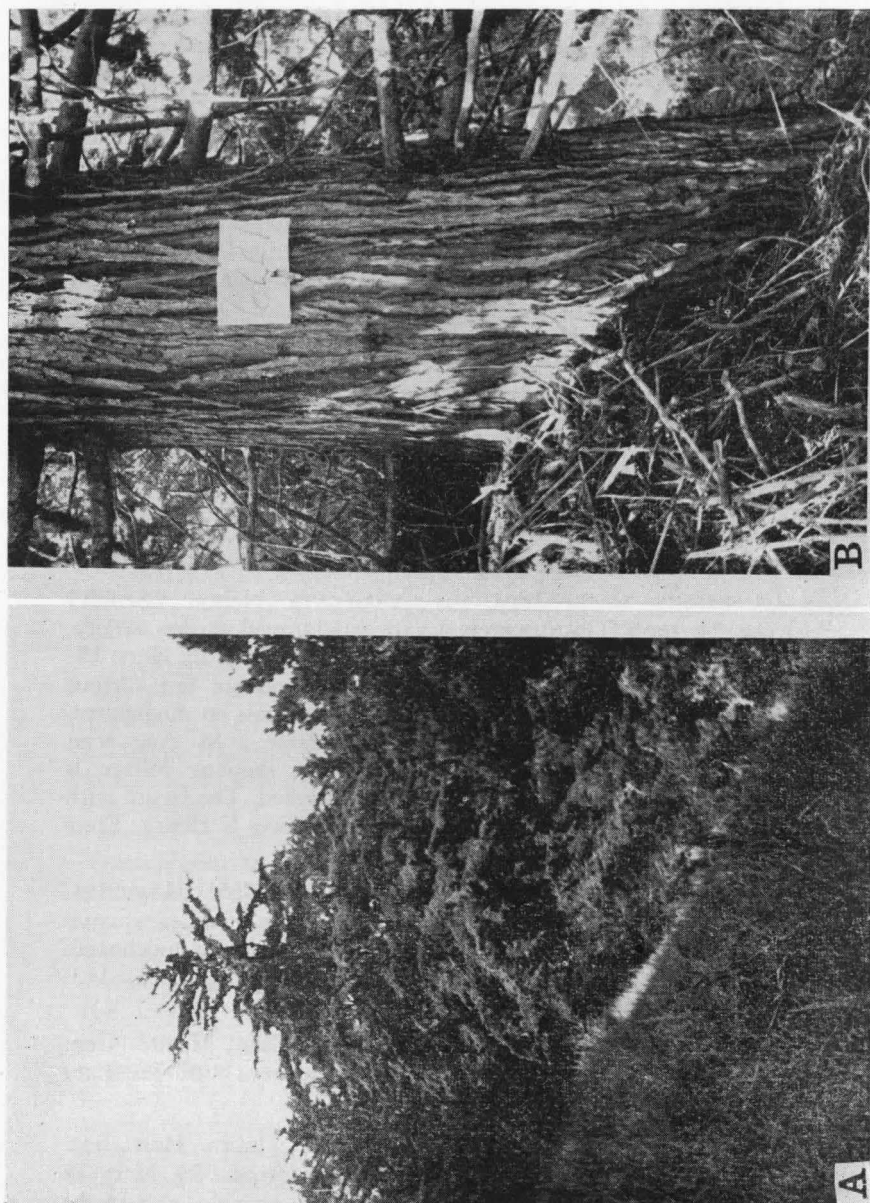
any such pigmy form of *C. macrocarpa*. Mr. Hornibrook does, however, mention two slow-growing forms, var. *compacta* and var. *Crippsii*, but these are quite different from the plant here described and apparently do not remain dwarf for long. I propose therefore, to name this new dwarf *Cupressus macrocarpa* forma *pygmaea**, with the following description:—A dwarf, compact shrub about 10 cm. high and 15 cm. in diameter, with widely spreading branches. Leaves dimorphic. Lower leaves in four ranks, broadly awl-shaped, about 1 mm. in length. Leaves (at the tips of the shoots) scale-like, appressed, glandular on the dorsal surface. The plant has been for the last four years in the possession of Mr. W. Bentley, of Quarry Wood, Burghelere, Hants., who kindly allowed me to photograph it. I understand that one cutting has been rooted. A. B. Jackson. *Footnote. *Cupressus macrocarpa* forma *pygmaea*, A. B. Jackson; forma nov. a type differt statura nana. Frutex perpygmaeus, compactus, circa 10 cm. altus et 15 cm. diametro, ramis patentibus. Folia dimorpha, inferiora late subuliformia patentia, superiora (ad ramulorum apices disposita) squamiformia adpressa dorso glandulosa." 2). Rehd., Man. Cult. Trees & Shrubs ed. 2. 56. 1940. "Very dwarf and dense, to 10 cm. high, with dimorphous lvs. Cult. 1936."

CUPRESSUS MACROCARPA var. *VARIEGATA* Nelson [Senilis] Pinaceae. 74. 1866. This is merely a variegated-leaved garden variety. "*Cupressus macrocarpa* foliis variegatis." 2). Lemaire, in Ill. Hort. 15: 587. Figs. 1868. "La variété a feuilles ponachées, qui fait surtout les sujets de notre article, a été trouvée dans un semis en Angleterre, et envoyée pour la première fois, a ce qu'il semble, a M. Aug. Van Geert, horticulteur, a Gand." The illustration showing foliage is typical of *C. macrocarpa* except that it is variegated. The figure with cones is from the Journ. Hort. Soc. Lond. 3). Elwes & Henry, Trees of Great Brit. & Irel. 5: 1165. 1910.

CUPRESSUS HARTWEGII Carr., Rev. Hort. 1855: 233. 1855. "Branches dressées, rapprochées, souvent confuses. Feuilles squamiformes, opposées outernées, acuminées—aigues, légèrement muchonnées au sommet." 2). Engelm., in Brew. & Wats., Bot. Calif. 2: 113. 1880. As a synonym only of *C. macrocarpa* Hartw.

CUPRESSUS HARTWEGII var. *FASTIGIATA* Carr., Traité Gén. Conif. ed. 2. 169. 1867. Based on *C. macrocarpa* var. *fastigiata* Knight.

CUPRESSUS LAMBERTIANA Hort. ex Gord., Journ. Hort. Soc. Lond. 4: 296. 1849. As a synonym of *C. macrocarpa*. 2). Hort. ex Carr., Traité Gén. Conif. 124. 1855. This possibly should be considered the authentic publication of this as a name although Gordon mentioned the name in 1849. *C. macrocarpa* Hartw. is listed as a synonym. He also recognized *C. Lambertiana* var. *fastigiata*

FIGURE 33. *Cupressus macrocarpa*.

based on *C. macrocarpa fastigiata* Knight. Carrière claims this (*C. Lambertiana*) was introduced in 1839.

CUPRESSUS LAMBERTIANA var. FASTIGIATA Carr., *Traité Gén. Conif.* 124. 1855. This is based on *C. macrocarpa fastigiata* Knight.

CUPRESSUS REINWARDTII Hort. ex Beissn., *Handb. Nadelh.* 103. 1891. 2). *Mast., Journ. Linn. Soc.* 31: 343. 1896. As a synonym only of *C. macrocarpa* Hartw. 3). *Elwes & Henry, Trees of Great Brit. & Irel.* 5: 1165. 1910. As a synonym only of *C. macrocarpa* Hartw.

FIGURE 33.

CUPRESSUS MACROCARPA—Monterey Cypress.
Point Lobos, Monterey Co., Calif. *Coll. No. 6227 (Prop. No. 2177)*.
A—Tree in sheltered spot; height 22 m. Photo Nov. 7, 1934. Neg. No. 3463.
B—Trunk of same tree.
The white card is 10 x 15 cm. Photo Nov. 7, 1934. Neg. No. 3464.

12. CUPRESSUS PYGMAEA—Mendocino Cypress*

Cupressus pygmaea (Lemm.) Sarg., Bot. Gaz. 31: 239. 1901. Dwarf trees a meter or so high when growing in sterile soils, and having a trunk only 1 to 2 cm., and a few branches 3 to 5 mm. in diam., and bearing a few ovulate cones; such dwarfs may be 10 or more years of age. Trees in richer soils are not at all dwarfed and range in height from 10 to 50 m. and 10 to 15 m. in spread, have a straight central trunk often over 1 m. in diam., with gray-brown, shreddy fibrous bark, seldom over 2 cm. thick. In general aspect the trees are dark, blackish, dull green, except when laden with staminate cones at which times they appear yellowish-green. A section of the trunk of Coll. No. 6176 was 36 cm. in circumference and 11 cm. in diam.; it had 57 annual rings of which the first 27 made up a circle only 2 cm. in diam., indicating that the tree in early years was dwarfed. Branchlets of the season are often unbranched for over 20 mm. and are 1 to 1.5 mm. in diam., leaves 1 to 1.5 mm. long, rather acutely pointed, and rounded on the back and devoid of any indication of a dorsal pit; the second season the branchlets become somewhat thicker, and on vigorous shoots some of the leaves become 7 to 10 mm. long, are 2 to 3 mm. wide and have an acute-spreading tip about 2 mm. long. Branchlets of the second season are somewhat thicker, and some of the leaves show a dark closed pit. On the branches which shed their leaves the second or third year, the bark becomes a smooth brown and remains so for many years. Staminate cones seem to be produced in great profusion at all seasons; these borne solitary on the ends of the branchlets and, at first, appear as slightly swollen green imbricated tips. At maturity these are somewhat 4-sided, 3 to 4 mm. long, 2 mm. thick, composed of 12 to 14 scales, these slightly imbricated, their margins fimbriate; each scale about 1.7 mm. long, about equally broad, triangular-obtuse at apex and nearly round at base; the extreme lower and upper scales bear only 3 or 4 pollen sacs while the rest usually have 5 sacs (none noted with 6 or more), all are attached in an irregular semicircle around the stalk and pendulous in lower half of the scale. At maturity the scales expand and the pollen sacs protrude between their margins. Ovulate cones abundant on dwarfed or mature trees, but on young vigorous trees are rare or even absent; cones often borne in congested clusters; solitary at the apex of short branchlets and, at first, appearing as thickened or swollen green inconspicuous tips about 2 mm. long and thick, these often adjacent to the staminate cones, but usually on slightly older branchlets. Just before pollination the ovulate cone enlarges to 3 or 4 mm. in length and width, the 8 or 10 scales stand erect or slightly spread and expose the numerous

*This species has also been called Pygmy Cypress, but the name is not applicable to the large trees. Furthermore, similar-sized dwarf cone-bearing individuals can be found in stands of most of the other species when growing in extremely sterile soils.

ovules; the scales close soon after pollination, and the cone develops to nearly 1 cm. in diam. the first season, is at first green, then changes to a rich tan and is nearly spherical, but slightly irregular, with a low broad erect or slightly incurved umbo on each scale. At maturity the cones are much more nearly spherical, average about 15 mm. in diam., but are occasionally over 20 mm. in diam., with less conspicuous umbos. As the cones remain on the trees for several years unopened, the surface becomes much grayer, and the umbos practically weather away. Each cone contains about 130 seeds, these are irregular, flattish, 3 to 4 mm. long, often as broad, with a stiff but thin narrow margin or wing and an inconspicuous hilum. Seeds from Fort Bragg and Mendocino City are jet black or very deep blackish-brown and are usually shiny, whereas, those from Anchor Bay are much more brownish. Cotyledons 3 or 4 (no seedlings with 5 cotyledons noted), these 8 to 12 mm. long, linear but a little flattened and with a blunt tip. The next leaves are borne in whorls of 4, are similar to the cotyledons, but are shorter, flatter and have an acute tip with a minute spine, and are rarely over 8 mm. long. During the second season, the branchlets produce leaves which gradually approach the mature type in shape and size.

Type Locality

"Sparsely found on the ashen 'white plains' back from the coast, near Mendocino"—Lemmon (1895). No specimens were cited by Lemmon, but three specimens from his herbarium are cited below, any one of which could be regarded as the type. These are in the University of California Herbarium.

Range

United States. California. Mendocino County. This species is confined to two main coastal areas, the first of which extends from about 2 miles east of Fort Bragg and reaches its northern limit somewhat south of Pudding Creek. From there it extends southward in a more or less continuous strip several miles in width in places to a similar inland section south and east of Mendocino City. Probably no trees of *C. pygmaea* extend to the Albion River.

Many accounts have been written regarding the peculiar "Mendocino White Plains" or "Pine Barrens" on which *Cupressus pygmaea* grows. The area is a remarkable one characterized by a sterile, white sandstone type of soil which forms a hardpan through which water percolates but slowly. During the winter months, shallow bogs or ponds are formed in the depressions, but during the rainless summer months, these areas are dry and dusty. Near the numerous dirt roads traversing this area, the kinds of vegetation are hardly

recognizable because of the heavy coating of yellowish-white dust which adheres to every leaf and twig, particularly because nearly every night and morning the damp fogs wet everything. *Pinus muricata* and *P. contorta* (including *P. Bolanderi*) are the abundant trees and are also stunted over much of the area. *Rhododendron californicum*, *Vaccinium ovatum*, *Arctostaphylos nummularia* and *Castanopsis chrysophylla* var. *minor* are the conspicuous shrubs, although others such as *Ceanothus gloriosus* var. *exaltatus* and *Ledum glandulosum* are somewhat less abundant. In the very early spring, *Viola sempervirens* is common in small patches wherever sufficient humus has accumulated.

Surrounding the "Barrens" occupied by the cypress trees, is the typical Humid Transition Life Zone with *Sequoia sempervirens*, *Pseudotsuga taxifolia* and colonies of *Abies grandis*, or in ravines *Alnus oregona*. The shrubs in these moister areas are *Myrica californica*, *Lonicera Ledebourii* and *Rubus spectabilis*.

Some authors in referring to the Pine Barrens speak of it as a "Peat Swamp" and as a "Wet Bog". It is true that there is at least one sphagnum bog in the area back of Fort Bragg, and I have visited it on several occasions, but it is very limited in extent and is not at all a gross feature of the area. During the winter months there is considerable water on the surface of the ground, as has been mentioned above, but in the summer these same areas are far from "boggy".

The cypress trees in the Fort Bragg and Mendocino area receive the greatest rainfall of any species in California, and also because of the closeness to the sea and the fog have the mildest and most continuously damp climate. Temperatures at Fort Bragg are mild and seldom drop much below 25 degrees F. nor rise to over 85 degrees, and the average summer day's maximum is much below this figure.

William C. Mathews at the instance of W. L. Jepson has made an especial study of the cypresses in the Fort Bragg area and his article: Measurements of *Cupressus pygmaea* Sarg. on the Mendocino "Pine Barrens" or "White Plains" (Madroño 1: 216-218. 1929) is quoted below in its entirety:

"I found three groves of *Cupressus pygmaea* on the Mendocino coast where the trees grew unusually large, both in girth and in height. In each case the trees grew in the low damp swales which during the winter months are covered with water for days at a time. On the outskirts of the swales the trees were smaller and not unusual in any way.

"One place (situation no. 1) where *Cupressus pygmaea* attains a large size is one and one-half miles north-north-east of Fort Bragg and about one and one-fourth miles from the ocean. A second place is about one-half mile east of situation no. 1. A third place is back of

Caspar and about two and one half miles from the coast. The trees in this last locality are not so large in girth as in the former sections, but they are splendid tall trees, averaging perhaps 2 feet in diameter. In this locality they are found in the forest associated with Redwood, Douglas Fir, Tan Oak, Chinquapin and Sitka Spruce.

"In the first two places the other species of trees had been cut down, leaving the Cypress standing, but on one forty-acre patch, the Cypress had been felled and sold to the Union Lumber Co. The Company sawed the logs and made lumber which was sold and manufactured into Cedar-wood boxes. Below are given the measurements of a number of trees. These measurements are fair and accurate. Where a tree trunk was exceedingly large for a few feet only, I did not measure it. I took measurements only on well-developed or symmetrical trees.

"Tree no. 1: trunk 100 in. in circumference at 30 in. from the ground; 84 in. in circumference 6 ft. from the ground. This latter circumference held good for 16 ft. and then tapered gradually to the top which was 100 ft. from the ground. The first branches were 30 ft. from the ground. This tree had been burned and the lower bark and some of the wood was gone. Cones were clinging to the dead top branches.

"Tree no. 2: trunk 80 in. in circumference at 5 ft. from the ground, 80 ft. high.

"Tree no. 3: a stump from which a log had been sold, $44\frac{1}{2}$ in. in diameter at 47 in. from the ground. I identified the stump by the bark and the remainder of the top which lay on the ground about 70 ft. from the stump.

"Tree no. 4: trunk 115 in. in circumference at 5 ft. above the ground. The trunk was even larger in girth higher up. This was a beautiful tree, almost perfectly symmetrical. It had been burned and was dead; it was 100 ft. to the broken top.

"Tree no. 5: trunk 80 in. in circumference at 5 ft. from the ground; a fine tree 80 ft. high, dead.

"Tree no. 6: felled tree left on ground, the trunk 2 ft. in diameter, 85 ft. high, 40 ft. to first branches.

"Tree no. 7: trunk 11 ft. 3 in. in circumference at 6 in. above the ground, held its size to 60 ft. and then diminished to a smaller diameter and grew 40 ft. higher. It had not been dead long because the top was literally loaded with branches and the branches in turn loaded with dried fruits.

"Tree no. 8: trunk 14 ft. 9 in. in circumference at 6 ft. above the base, holding its diameter well to 50 ft. It was badly burned at the base, so had the tree been measured when intact it would have been considerably greater in circumference.

"Tree no. 9: trunk 102 in. in circumference at 6 ft. from the ground; 90 ft. high. Its branches were self pruned to within 20 ft. of the top.

"Tree no. 10: stump of a tree felled for the log, 37 in. in diameter at 3 ft. above the ground. A 60-ft. log had been taken and the top was left lying on the ground. The diameter at 60 ft. was $19\frac{1}{2}$ in. The tree was 136 ft. high.

"Tree no. 11: trunk 38 in. in diameter at 4 ft. from the ground. Measurement taken on a stump.

"Tree no. 12: trunk 11 ft. in circumference, nearly 200 ft. high and holding its diameter exceedingly well towards the top.

"The above trees were measured in situation no. 1, as given above. In situation no. 2, I measured the largest tree I ever saw of this species. This tree had a trunk 27 ft. in circumference at 5 ft. above the ground and was well over 150 ft. high. The tree was dead but the bark was still clinging to the tree and the wood was sound. In the same locality, on about 40 acres, there were many trees of large size, all standing, but trees of other species were nearly all cut down, leaving almost a pure forest of the Cypress. Hundreds and thousands of Cypress seedlings were springing up all over the place and especially about the base of the trees. I noticed where a tree had fallen that a large semicircle of seedlings grew about the crown for quite a distance around but not near the center of the tree. This is due to the fact that the lower branches die leaving the top branches covered with fruit and when the tree falls the seeds are sown broadcast from the top.

"All the Cypress trees of the Mendocino County coast grow on the "prairie" or "plains" region or in the forest adjoining the "plains". The bark is thin and gray in the larger trees but in the smaller trees it is brown and more fibrous. The bark seems to be laid on in strips and peels easily this time of the year. The bark remains intact while the tree lives but peels naturally after death. The wood splits easily and when dried out makes a good fire wood. The sap wood is from $1\frac{1}{2}$ in. to $2\frac{1}{2}$ in. thick in the larger trees. Fort Bragg, January, 1914."

Collections:

a). J. T. Howell, Coll. No. 701 (*Prop. No. 270*), August 25, 1927, from 3 miles east of Fort Bragg, a tree 13 m. high, 6 to 7 m. in spread and with a trunk 3 dm. in diam. b). C. B. Wolf, No. 1333, September 1, 1927, 3 miles from Fort Bragg on the Willits road. c). C. B. Wolf, Coll. No. 1788 (*Prop. No. 1044*), October 31, 1930, same locality as Wolf No. 1333, from a tree nearly 12 m. high, 6 to 7 m. in spread and with a trunk 2.5 dm. in diam. d). C. B. Wolf and E. R. Johnson, Coll. No. 6174 (*Prop. No. 2133*, our Fort Bragg No. 1 Strain), October 12, 1934, 2.1 miles east of Fort

Bragg on Oak Street, from a tree nearly 20 m. high, 8 to 10 m. in spread and with a trunk 4.5 dm. in diam. at 1 m. e). C. B. Wolf and E. R. Johnson, Coll. No. 6175 (Prop. No. 2134, our Fort Bragg No. 2 Strain), October 12, 1934, from 1.5 miles east of the Fort Bragg to Mendocino City road on the road to Willits, from dwarf trees all less than 2 m. in height. f). James McMurphy, No. 519, July 16, 1909 (R. S. A., Dudl. Herb.), between Fort Bragg and Bald Hill, tree 114 ft. high, $24\frac{1}{2}$ ft. circumference. g). C. B. Wolf and E. R. Johnson, Coll. No. 6176 (Prop. No. 2135, our Mendocino City Strain), October 12, 1934, from 2.4 miles east of Mendocino City on the road to Ukiah, from a tree 10 m. high, 3 m. in spread and with a trunk 1.5 dm. in diam. A section of the trunk of this tree was about 11 cm. in diam. and had 57 annual rings, of which the first 27 accounted for only about 2 cm. of the total diam. Several possibilities suggest themselves to explain this speed-up in growth. The most likely is that the tree finally got its roots through the hardpan and was, thus, able to draw on adequate foods and moisture. Another possibility is that in its early years it was greatly crowded by other similar trees, and none had a chance to grow rapidly; then a large number of the surrounding trees were removed by fire or otherwise, and competition was not so severe. h). C. B. Wolf, Coll. No. 11460, October 23, 1944, from about 2 miles east of Mendocino City. This collection consists entirely of dwarf trees, each of which is suitable in its entirety as a fruiting specimen for an herbarium sheet. Most of these were collected adjacent to the road. In fact, these small trees are so prevalent along the roads through the "Pine Barrens" that they are to be classed as a weed. i). J. G. Lemmon and Wife, 188—, (U. C. Herb.). This sheet is labelled "*Cupressus Goveniana* var. *pygmaea* n. var. ined. White Ashy Plains near Mendocino." j). Lemmon Herb., Aug. 3, 1894 (U. C. Herb.). k). Lemmon Herb., Aug. 5, 1894 (U. C. Herb.). The above collections from the Lemmon Herbarium are the only ones I have seen which could be regarded as the Type of *C. Goveniana* var. *pygma*, and if any should be thus designated, it should be the first of the three.

The second and only other known area for *Cupressus pygmaea* lies approximately 35 miles to the south of the above mentioned stands. It is reached by driving about 1.6 miles inland from Anchor Bay on the road to Yorkville. At this station the trees are limited to an area of less than a mile in extent, but have been subjected to many fires in the past which may have reduced the size of the stand considerably. The main portion of the trees lies at nearly 1000 ft. elevation and is part of a *Pseudotsuga taxifolia* and *Pinus muricata* forest. The soil is a yellow sandstone hardpan somewhat like that of the Fort Bragg area; but is, apparently, less sterile and slopes so that water never stands in winter. Most of the trees are

dwarfed or small as at Fort Bragg, but some which have escaped the fires are nearly 20 m. high. At the time of our visit to this grove in the fall of 1934, a recent fire (within a couple of years) had burned many of the trees, but they were still standing as dead individuals, and many still retained their opened cones upon the branches.

On October 22, 1944 I was again able to visit the stands of *C. pygmaea* back of Anchor Bay. In addition to the associated plants mentioned above, I noted that *Arctostaphylos nummularia*, *Castanopsis chrysophylla* var. *minor* and *Vaccinium ovatum* were abundant. Most of the area occupied by the cypresses and which was burned over prior to 1934 has again grown up to shrubbery, but there was little indication of any thickets of new cypresses. Many of the cypress trees were heavily laden with staminate cones, thus giving the entire trees a yellowish appearance. In fact, I concluded that *C. pygmaea* in this area is rapidly approaching extinction, and that a few more properly timed fires would greatly hasten the process.

I am unable to determine how I found out about the Anchor Bay grove, or how long it has been known to botanists, but no published notes regarding it have ever been located.

Collection:

C. B. Wolf and E. R. Johnson, Coll. No. 6178 (Prop No. 2137, our Anchor Bay Strain), October 13, 1934, from a tree about 19 m. high, about 8 m. in spread and branched into several trunks close to the ground, these varying from 1.5 to 6 dm. in diam., but the largest forming a long slender leader well above the others; seeds brownish-black, NOT SHINY JET BLACK as in the Fort Bragg and Mendocino City specimens. In this latter feature, the trees have something in common with *C. Goveniana*, but their other characteristics place them definitely with *C. pygmaea*.

Collections of Cultivated Specimens

a). P. C. Everett, Coll. No. 7789, May 19, 1936, seedlings of Prop. No. 2133, from 4 in. pots in Garden nursery, seed flat planted March 28, 1935; 17, 18 and 23 cm. high, still slender, with juvenile spreading leaves; roots not very much developed, indicating recent potting. b). P. C. Everett, Coll. No. 7790, May 19, 1936, seedlings of Prop. No. 2134, from 4 in. pots in Garden nursery, seed flat planted March 28, 1935; 20 and 21 cm. high, with juvenile spreading leaves; main central leader well developed; root system very well developed with numerous fibrous roots. c). P. C. Everett, Coll. No. 7790, May 19, 1936, seedlings of Prop. No. 2135, from 4 in. pots in Garden nursery, seed flat planted March 28, 1935; 21 and 26 cm. high, with juvenile spreading leaves, main central leader well developed; root system very well developed with excep-

tionally numerous fibrous roots. d). P. C. Everett, Coll. No. 7792, May 19, 1936, seedlings of Prop. No. 2137, from 4 in. pots in Garden nursery, seed flat planted March 28, 1935; 17 and 22 cm. high, with juvenile spreading leaves; root system well developed.

Relationships

Cupressus pygmaea has long been regarded by many botanists as conspecific with *C. Goveniana* or, at the most, only a variety of that species. It is true that from dried herbarium material alone the two species would be difficult to distinguish. However, upon the basis of our studies, I feel that these two plants have fundamental differences which, when taken together, are of significance, even when not visible on herbarium specimens. In fact, the species of *Cupressus* under consideration in this paper can not be satisfactorily understood on that basis unless supplemented by other data. The bushy growth and light green foliage of *C. Goveniana* are in strong contrast to the tall and slender habit of *C. pygmaea* under good conditions; the latter also has a deep, dark blackish-green foliage. As young trees *C. Goveniana* is much more beautiful. The extreme vigor of *C. pygmaea*, which enables it to attain heights of nearly 50 m., is greatly different from *C. Goveniana* which is not known to grow over 10 m. high. These growth differences can not be attributed to the native soils, for under cultivation the differences in growth are even more pronounced. Cone characters are of little value here, and the seeds of only a little more significance; those of *C. Goveniana* are either deep dark brown or dull black, those of *C. pygmaea* are jet black and shiny from the Fort Bragg and Mendocino area, but are brownish or brownish-black from Anchor Bay. To reduce *C. pygmaea* to synonymy or subordinate rank under *C. Goveniana* would be justifiable in a very conservative treatment of the genus; but, as pointed out under *C. Goveniana*, a number of other consolidations would have to be made, and some other means would have to be used to distinguish these entities which rest on such poorly marked morphological characteristics.

References

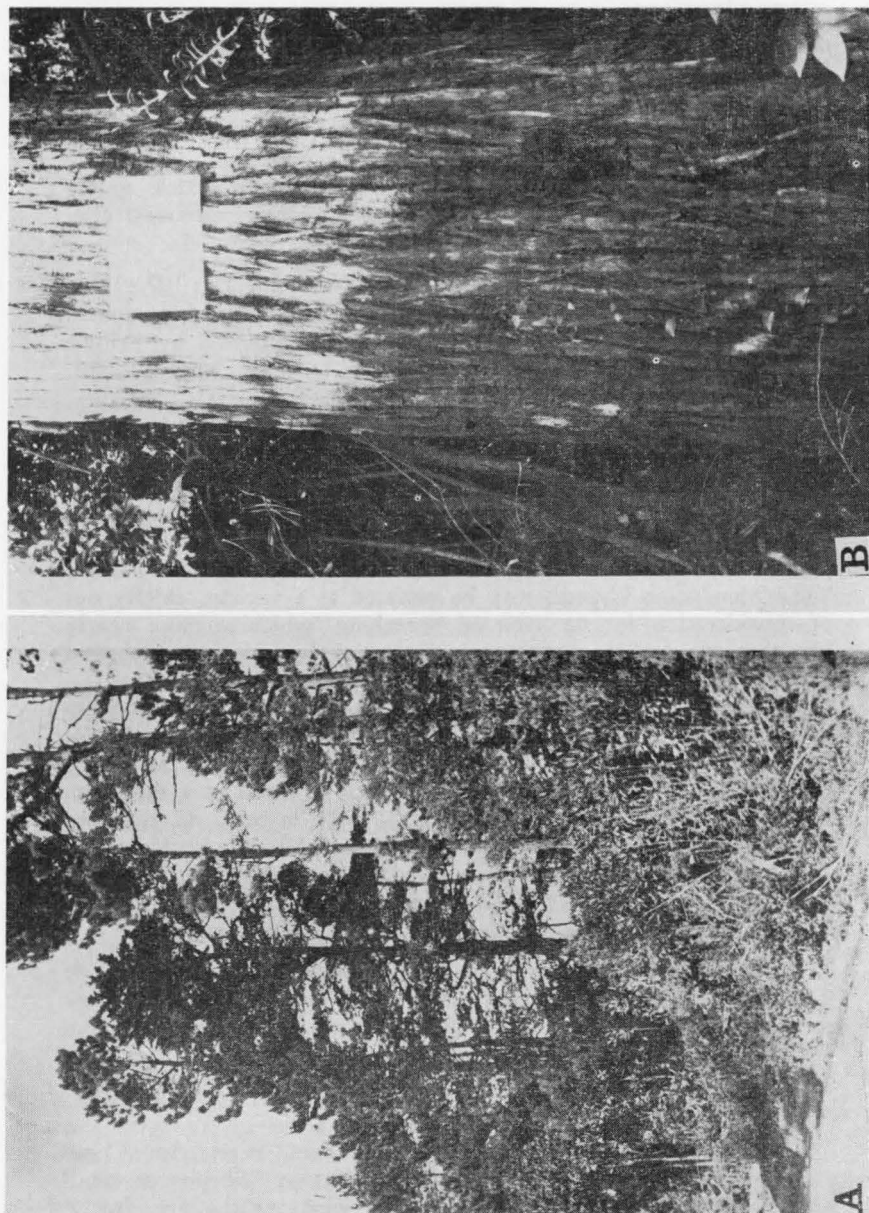
CUPRESSUS PYGMAEA Sarg., Bot. Gaz. 31: 239. 1901. New combination, based on *C. Goveniana* var. *pigma* Lemm. It is apparent from Sargent's discussion that his concept of *C. Goveniana* was largely based on material which is here referred to *C. Sargentii*; and it was, therefore, easy for him to set up marked distinctions for *C. pygmaea*. 2). Sudw., For. Trees Pac. Slope. 163. Fig. 63. 1908. 3). Brit., No. Am. Trees 100. Fig. 75. 1908. 4). Camus, Les Cypres 50. 1914. This species is listed by Camus, following *C. Goveniana*, but is not given a separate number in her sequence of species. She cites Monterey

and Mendocino Co. as localities for *C. pygmaea*, indicating that she did not properly understand the distinctions between it and *C. Goveniana*. 5). Jepson, Man. Fl. Pl. Calif. 58. 1923. 6). Rehd., in Bailey, Cycl. Hort. new ed. 1: 916. 1925. This species is given incidental mention at the close of the account of the genus, possibly because Rehder did not consider it to be in cultivation. 7). W. C. Matthews, Madroño 1: 216-218. 1929. This is an article giving measurements of native trees of *C. pygmaea* and is discussed elsewhere in the text.

CUPRESSUS GOVENIANA Sarg., Silva No. Am. 11: 107. 1896, in part, as to the "plains of Mendocino" locality. 2). Mast., Journ. Linn. Soc. 31: 346. 1896, in part, as to the collection by Pringle from the Mendocino Plains. 3). Jepson, Fl. West. Middle Calif. 25. 1901, in part, as to the "Plains of Mendocino Co." locality. 4). Jepson, Fl. Calif. 1: 60. 1909, in part, as to the "Mendocino White Plains" locality. *C. Goveniana* var. *pygmaea* Lemm., *C. pygmaea* Sarg. and *C. Goveniana* var. *parva* Lemm. are listed as synonyms. 5). Jepson, Silva Calif. 153. 1910, in part. Jepson regards *C. Goveniana* var. *pygmaea* Lemm. and var. *parva* Lemm. and *C. pygmaea* Sarg. as synonyms of *C. Goveniana* but (p. 154) says: "The Mendocino Cypress may be retained as a variety, chiefly out of consideration for its habit of branching, which is more nearly like that of *Cupressus macrocarpa*. It has, however, no technical points of difference from the Monterey type of *Cupressus Goveniana*." 6). Abrams, Ill. Fl. Pac. States 1: 73. 1923, in part, as to the Mendocino Co. locality. *C. pygmaea* Sarg. is listed as a synonym. 7). Sarg., Man. Trees No. Am. 2nd ed. 70. 1926, in part, as to the Mendocino Co. localities. *C. pygmaea* Sarg. is listed as a synonym. 8). Sudw., U.S.D.A. Misc. Circ. 92: 37. 1927, in part. *C. pygmaea* is listed as a synonym. 9). Van Dersal, Nat. Woody Pl. U.S. 114. 1938, in part. *C. pygmaea* Sarg. is listed as a synonym. 10). McMinn, Ill. Man. Calif. Shrubs 41. 1939, in part, as to the Mendocino White Plains locality. *C. pygmaea* Sarg. is listed as a synonym.

CUPRESSUS GOVENIANA var. PARVA Lemm., Sierra Club Bull. 4: 116. 1902 Original description: "On the 'White Plains', a narrow strip of poor clay land paralleling the ocean a few miles back from the town of Mendocino." Lemmon offers no explanation for describing this variety when he had already proposed var. *pigma* for the same thing in 1895.

CUPRESSUS GOVENIANA var. PIGMA Lemm., West. Am. Cone-bearers 3rd ed. 77. 1895. Original description: "Shrubs or small trees from 4 inches to 10 feet high, but whatever the size, freely-bearing and often retaining the cones through many years; cones small, about $\frac{1}{2}$ inch thick, of few scales and seeds. Sparsely found on the ashen 'white plains' back from the coast, near Mendocino."

FIGURE 34. *Cupressus pygmaea*.

2). Elwes & Henry, *Trees of Great Brit. & Irel.* 5: 1171. 1910. Written as *pygmaea*. 3). Dalli. & Jacks., *Handb. Conif.* 198. 1923. Written as *pygmaea*. 4). Rehd., in Bailey, *Cult. Evergr.* 209. 1925. Written as *pygmaea*. "Low shrub: Cones smaller, with small black seeds. Mendocino County."

FIGURE 34.

CUPRESSUS PYGMAEA—Mendocino Cypress.

"Pine Barrens", 2 mi. east of Fort Bragg, Mendocino Co., Calif. *Coll. No.* 6174 (*Prop. No.* 2133).

A—Tree about 20 m. high; adjacent trees are *Pinus muricata* Don. Photo Oct. 12, 1934. Neg. No. 3275.

B—Trunk with rough, fibrous bark, the surface with considerable growth of mosses and lichens. The white card is 10 x 15 cm. The adjacent vegetation is *Vaccinium ovatum* Pursh. Photo Oct. 12, 1934. Neg. No. 3277.

13. CUPRESSUS GOVENIANA—Gowen Cypress

Cupressus Goveniana Gord., Journ. Hort. Soc. Lond. 4: 295. Fig. 1849. Small erect tree 5 to 7 m. high, 2 to 4 m. spread, trunk 1 to 2 dm. in diam.; branching rather sparse, especially when growing in thickets, and then becoming cane-like with straight clean trunks and only a few branches to the crown. Bark of main trunk smooth brown to gray, only 3 or 4 mm. thick, or on old trees rough and fibrous. Central leader straight, the side branches at first joining it at an angle of about 45 degrees but later bending down and becoming horizontal or even somewhat deflexed, usually of irregular lengths. A lateral branch 21 cm. in circumference had about 20 annual rings. Branchlets slender, 1 to 1.5 mm. thick, opposite or alternate, disposed on all sides of the branches, usually those of the season are less than 10 mm. long, but occasionally under shade conditions or during rapid growth, these may elongate to over 30 mm. before branching. Leaves light rich green or even a little yellowish-green, 1 to 2 mm. long, 1 mm. wide in the lower two-thirds, the upper one-third acute but blunt-pointed and closely appressed to the branch, most leaves are without visible dorsal pits, but some show this as an inconspicuous oval or round spot which is never active. These leaves may remain on the branch for several years or on vigorous shoots elongate rapidly to 5 mm. or more in length, 3 or 4 mm. in width and have a spreading acute tip; usually after a few months these leaves turn brown, but remain on the branch for a year or two and gradually are pushed off by the expanding bark of the branch. Staminate cones produced in great profusion at the tips of short branchlets and when mature often give the entire tree a very distinctly yellowish cast; these cones 3 to 4 mm. long, 1.5 to 2 mm. thick, obscurely 4-sided, composed of 12 or 14 scales, these slightly imbricated with their margins slightly fimbriate; each scale bears several pollen sacs, the basal and terminal ones only 3 or 4 and the central ones 5 or 6, all attached in an irregular semi-circle on the lower half of the scale. At first, these are green, but at maturity are yellowish and spread apart slightly allowing the pollen sacs to protrude. Ovulate cones abundant, produced on tree as young as 4 years old, usually in closely aggregated clusters, although, in reality, solitary on short branchlets. When first visible the ovulate cones are green and inconspicuous, appearing as a slightly swollen vegetative tip, a little later becoming 3 to 4 mm. long, and the 6 to 10 scales spread apart disclosing the numerous ovules. After pollination the scales close, and during the first season the cone gradually turns from green to a glossy brown and is usually less than 1 cm. in diam., somewhat angular, and the umbos are prominent as flattened erect or slightly spreading horns. During the second season the cones become woody, the umbos weather

away, and the surface changes from brown to a gray-brown, later becoming dull gray. At maturity the cones are only 10 to 15 mm. long, nearly globose, do not open for several years and continue to have green coloring beneath the surface. Seeds average from 90 to 110 per cone, are irregularly shaped, narrowly margined, dull dark brown to nearly black, are 3 to 4 mm. long (mostly only 3 mm.) and are sometimes a little broader than long and have an inconspicuous light hilum. Cotyledons 3 to 5, usually 4, in germination the seed coat is carried above the ground by the cotyledons and pushed off as they expand; the cotyledons become green and foliar, are 8 to 12 mm. long, linear and a little flattened but blunt-pointed. The next leaves are similar but shorter and slightly flatter and have a minute spiny tip and are usually in whorls of 4 (sometimes 3). During the second year, the branchlets gradually produce leaves more like the mature type, and by transitional forms all eventually are of the mature type.

Type Locality

"This fine cypress was first discovered by Mr. Hartweg, on the western declivity of the mountains of Monterey in upper California, within two miles of the seashore, in company with *Pinus muricata*, forming a dense bush 6 to 10 feet in height. It has been named in compliment to James Robert Gowen, Esq., the society's present Secretary." Gord., Journ. Hort. Soc. Lond. 4: 295. 1849. Gordon stated that the species had been raised from Californian seeds collected by Mr. Hartweg. The plate on page 295 is apparently the Hartweg type and is not numbered. It shows little or no foliage and has nine cones with rather pronounced horns. The type is presumably in the Kew Herbarium.

Range

United States. California. Monterey County. Known only from two localities; the original station being on the western slopes of Huckleberry Hill back of Point Cypress, and the other in a somewhat similar situation southeast of Point Lobos on a ridge between San Jose Creek and Gibson Creek. These two groves are situated not over 6 miles apart by airline and are of interest in that they both lie in close proximity to the only two native groves of *Cupressus macrocarpa*, but in each case there seems to be a gap between the two species, and they are not known to grow together.

Cupressus Goveniana grows in the Humid Transition Zone; and, partly because of the nearness of the sea, the trees are constantly subjected to moist air. Throughout the late spring and summer, the region is bathed in moist fogs which drift in from the ocean each afternoon or evening and often do not lift until the following

afternoon. Considerable moisture collects on the foliage and trunks of the cypress trees and runs down moistening the ground. Temperatures in this area seldom rise to over 80 degrees F. or go below 20 degrees (seldom much below 32 degrees F.).

Localities

1. Huckleberry Hill, Monterey County. The summit of Huckleberry Hill is approximately 815 ft. in elevation and is about 3.5 miles east of Point Cypress on Seventeen Mile Drive, or about 2 miles due north of the business district of the city of Carmel. The western slopes of Huckleberry Hill, as the name implies, have considerable brushy growth of *Vaccinium ovatum*. Other shrubs are *Diplacus aurantiacus*, *Rhododendron californicum*, *Arctostaphylos Hookeri* and *A. tomentosa* (in the broad sense). The immediate tree associate of *Cupressus Goveniana* in this area is *Pinus muricata*, which forms almost impenetrable thickets on the sterile somewhat solidified sandy soil. In adjacent areas where the soil is deeper and more fertile, *Pinus radiata* is abundant. Much of this area is so thickly covered with *Cupressus Goveniana* and *Pinus muricata* that neither species can develop properly; both grow up as dwarf canes 2 to 4 m. high with only a few weak branches and a few cones. Many of these "canes" of the cypress have been cut for posts, a usage for which they are ideal, but because of this, it is now difficult to determine what may have been the original extent of the grove of *Cupressus Goveniana*. There are still a great many thousands of individual cypress trees on Huckleberry Hill, but the area occupied does not appear to extend for more than a mile in any direction. The largest trees are only about 5 m. high, 3 m. spread and have trunks only a little more than 1 dm. in diam. One tree that had fallen over, but which was still alive, would have measured nearly 7 m. high if erect. Examination of the seeds from numerous trees in this area disclosed (1934) that about one-half of the trees produced deep brown seeds, and the others had seeds nearly black (none shiny black as in *C. pygmaea*).

Collections:

a). L. R. Abrams, No. 10937, July 15, 1925 (R. S. A., Dudl. Herb.); b). C. B. Wolf, Coll. No. 1813 (Prop. No. 1069), November 7, 1930, from about 500 ft. elevation, a tree 6 to 7 m. high, with 3 m. spread and a trunk 12 cm. in diam. and brown seeds; c). C. B. Wolf, Coll. No. 1814 (Prop. No. 1070), November 7, 1930, from about 500 ft. elevation, a tree 2 m. high, 2.5 m. in spread, with a trunk 7 cm. in diam. and nearly black seeds; d). C. B. Wolf, Coll. No. 6231 (Prop. No. 2182, our Huckleberry Hill No. 1 Strain), November 8, 1934. Probably same tree as Coll. No. 1814; e). C. B. Wolf, Coll. No. 6232 (Prop. No. 2183, our Huckleberry Hill No. 2 Strain),

November 8, 1934, from a tree 5 m. high, with 3 m. spread and a trunk 13 cm. in diam.

2. San Jose Creek, Monterey County. The second grove of *C. Goveniana* is situated on a somewhat similar slope to that of the Huckleberry Hill grove, but the somewhat solidified sand is less sterile as indicated by the greater abundance of *Pinus radiata*. *Pinus muricata* is also present as is *Vaccinium ovatum*. The grove of cypresses is limited in extent, and there is probably only a fraction of the trees found at Huckleberry Hill. The grove is located about one mile east of the entrance to Point Lobos State Park (set aside to preserve the Point Lobos grove of *Cupressus macrocarpa*). The first trees are scattered over a slope at about 200 ft. elevation, but are more abundant slightly higher up. The largest trees noted were approximately 6 to 7 m. high, 6 to 7 m. in spread and had trunks about 2 dm. in diam. Like the trees on Huckleberry Hill the trunks were thin, gray-barked and the cones were produced in abundance.

Collections:

a). L. R. Abrams, No. 12687, December 19, 1929 (R. S. A.); b). C. B. Wolf, Coll. No. 6229 (Prop. No. 2179, our San Jose Creek No. 1 Strain), November 7, 1934, 200 ft. elevation, a tree 6 to 7 m. high, 6 to 7 m. in spread and with a trunk 2 dm. in diam; c). C. B. Wolf, Coll. No. 6230 (Prop. No. 2181, our San Jose Creek No. 2 Strain), the same spot as the above and also the same dimensions on the tree; d). Slevin photo No. 1704, 1931 (Calif. Acad.), labelled, 2-4 miles south of Carmel. This shows some typically rough-fibrous barked trees. I have not been able to locate any in this stand with similar bark and am, therefore, glad to have this feature demonstrated.

Collections of Cultivated Specimens

a). C. B. Wolf, May 29, 1931, seedlings of Prop. No. 1069, from a Garden outside seed bed planted December 3, 1930; 3-7 cm. high, cotyledons still present; these seedlings had not been transplanted and had developed a taproot over 15 cm. long, with few fibrous lateral roots. b). C. B. Wolf, May 29, 1931, seedlings of Prop. No. 1070, from a Garden outside seed bed planted December 3, 1930; 11-13 cm. high, cotyledons still present; these seedlings had not been transplanted and had developed a taproot over 15 cm. long, with few fibrous lateral roots. c). P. C. Everett, Coll. No. 7802, May 19, 1936, seedlings of Prop. No. 2179, from 4 in. pots in Garden nursery, seed flat planted March 28, 1935; 16 and 22 cm. high, with juvenile spreading leaves; root system well developed. d). P. C. Everett, Coll. No. 7803, May 19, 1936, seedlings of Prop. No. 2179, from 4 in. pots in Garden nursery, seed flat planted

March 28, 1935; 18 and 25 cm. high, with juvenile spreading leaves; root system well developed. e). P. C. Everett, Coll. No. 7804, May 19, 1936, seedlings of Prop. No. 2182, from 4 in. pots in Garden nursery, seed flat planted March 28, 1935; 17 and 19 cm. high, with juvenile spreading leaves; root system well developed. f). P. C. Everett, Coll. No. 7805, May 19, 1936, seedlings of Prop. No. 2183, from 4 in. pots in Garden nursery, seed flat planted March 28, 1935; 15 and 18 cm. high, with juvenile spreading leaves; root system very well developed (almost excessive for size of container).

Relationships

Cupressus Goveniana is historically the second species of the genus to be described from California. It has been confused with numerous other entities now recognized as distinct species. However, as here delimited, the species is regarded as belonging to the group of four species including *C. macrocarpa*, *C. Abramsiana* and *C. pygmaea*. The first of these is the most distinctive and is easily separated by its vigorous growth, large size, very shreddy-barked trunks, large cones and large rich brown seeds. *C. pygmaea* also has shreddy bark on old trees but is otherwise different from *C. macrocarpa* and is sometimes regarded as conspecific with *C. Goveniana*. The latter, apparently, never grows to much over 7 m. in height in its native habitat, and its foliage is a soft green, often with a yellowish cast. On the other hand, *C. pygmaea* attains heights of over 30 m., is slenderer, even when young, and has foliage with a dull dark green or even blackish-green cast. Cones of *C. Goveniana* and *C. pygmaea* are very similar in size and shape, but the seeds of the latter are most frequently a rich jet black, whereas, those of *C. Goveniana* are a dull brown or dull blackish-brown. The crown of *C. Goveniana* is generally bushy and without a long slender leader unless growing in thickets, in which case it is sparse, but even then without a long leader. *C. pygmaea* generally has a sparse crown and a slender leader. The relationship of *C. Goveniana* to *C. Abramsiana* is more complex. Wild trees of the latter look like fine young specimens of *C. macrocarpa* but are not so coarse; but the clusters of cones suggest either *C. pygmaea* or *C. Goveniana*. *C. Abramsiana* has cones considerably larger than either of those species and seeds that are also much larger and which are usually slightly glaucous. A very conservative treatment would be to combine *C. pygmaea* with *C. Goveniana*, but if this were done, then *C. Abramsiana* would have to be disposed of and its intermediate position between *C. Goveniana* and *C. Sargentii* would make it difficult to decide where it should go, unless *C. Sargentii* were also included in the above group.

References

CUPRESSUS GOVENIANA Gord., Journ. Hort. Soc. Lond. 4: 295. Fig. 1849. Original description, see discussion under Type Locality in text. "Raised from California seeds collected by Mr. Hartweg." The figure on p. 295 is not numbered. It shows little or no foliage; there are nine cones with rather pronounced horns. 2). Carr., *Traité Gén. Conif.* 125. 1855. Said by Carrière to have been introduced in 1847. 3). Gord. & Glend., *Pinet.* 60. 1858. 4). Parl., in DC. *Prod.* 16: 472. 1864. Cites *Hartweg n.* 1971, and lists *C. californica* Carr. and *C. cornuta* Carr. as synonyms. 5). Engelm., in Brew. & Wats., *Bot. Calif.* 2: 114. 1880, in part, as to the reference to Monterey. 6). Lemm., *West. Am. Conebearers* 3rd ed. 76. 1895, in part, as to the Monterey Bay reference. 7). Sarg., *Silva No. Am.* 11: 107. Tab. DXXVII. 1896, in part, as to distribution; the illustration was later considered by Sargent to be *C. Sargentii* Jepson (see Sarg., *Man. Trees No. Am.* 2nd ed. 71. 1926). 8). Mast., *Journ. Linn. Soc.* 31: 346. 1896, in part, as to the reference to Monterey. 9). Jepson, *Fl. West. Middle Calif.* 25. 1901, in part, as to the Monterey reference. 10). Lemm., *Sierra Club Bull.* 4: 116. 1902, in part, as to the reference to Monterey Co. 11). Brit., *Trees of No. Am.* 99. Fig. 74. 1908, in part. The illustration, like most others in *Cupressus*, is not readily determinable as this species and could just as well be *C. Sargentii*. 12). Sudw., *For. Trees Pac. Slope* 161. Fig. 62. 1908, in part, as to the description and the Huckleberry Hill locality. 13). Jepson, *Fl. Calif.* 1: 60. 1909, in part, as to the Monterey reference. 14). Jepson, *Silva Calif.* 153. 1910, in part. 15). Elwes & Henry, *Trees of Great Brit. & Irel.* 5: 1171. 1910, in part. *C. californica* Carr. *Conif.* 127. 1855, *C. attenuata* Gord. *Pinet.* 57. 1858, and *C. Sargentii* Jepson are listed as synonyms. Varieties *attenuata* Carr. *Conif.* 172. 1867, *pendula* with a synonym *C. californica* Carr., and *pygmaea* Lemm. are recognized. Under distribution these authors include the Mayacamas Range, Mt. Tamalpais, Cedar Mt., Santa Cruz and Santa Lucia Mts. All of these but the Santa Cruz Mt. locality, which is for *C. Abramsiana*, are referable to *C. Sargentii* Jepson. Their *C. Goveniana* thus includes *C. Abramsiana*, *C. pygmaea* and *C. Sargentii* as characterized in this treatment. 16). Camus, *Les Cyprès* 48. 1914, in part. Camus lists *C. pygmaea* following *C. Goveniana* but does not give it a number in her sequence of species. She also cites the distribution for *C. pygmaea* as Monterey and Mendocino Co., indicating that she was confused as to these two species. 17). Jepson, *Man. Fl. Pl. Calif.* 58. 1923. Considered by

FIGURE 85.

CUPRESSUS GOVENIANA—Gowen Cypress.

Huckleberry Hill, Monterey Co., Calif. *Coll. No.* 6232 (*Prop. No.* 2183).A—Tree 5 m. high. The thickets in the background are largely a mixture of *Pinus muricata* and *Cupressus Goveniana*. Photo Nov. 7, 1934. Neg. No. 3488.

B—Trunk 13 cm. in diam. Photo Nov. 7, 1934. Neg. No. 3490.

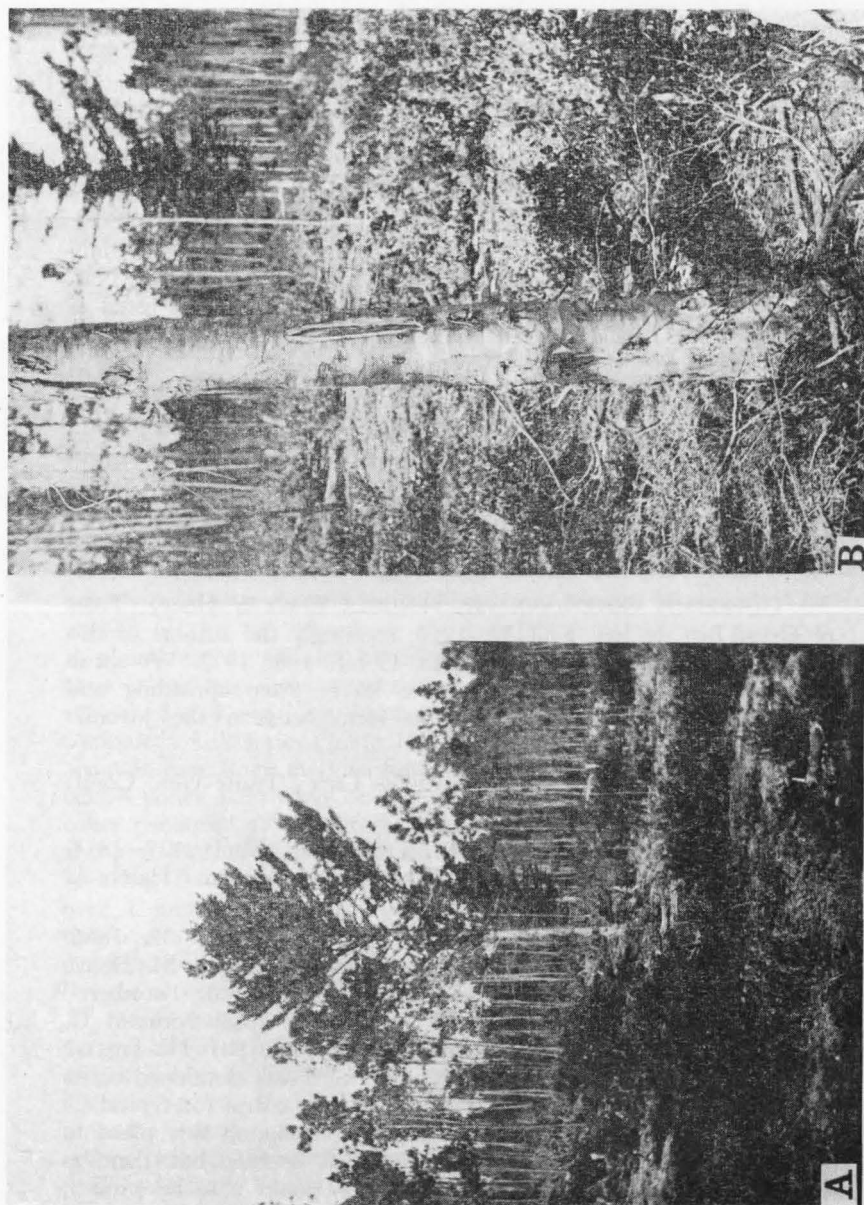


FIGURE 35. *Cupressus Goveniana*. See opposite page.

Jepson to be a shrub rather than a tree. 18). Dalli. & Jacks., Handb. Conif. 198. 1923, in part. 9). Rehd., in Bailey, Cult. Evergr. 209. 1925, in part. Said by Rehder to have been introduced into cultivation in England in 1846. However, most other authorities give 1847 as the proper date, which is more likely correct since seeds collected by Hartweg could hardly have reached England prior to 1847. 20). Sarg., Man. Trees No. Am. 2nd ed. 70. 1926, in part, as to the Monterey locality. 21). Sudw., U.S.D.A. Misc. Circ. 92: 37. 1927. As to name only, for apparently by error Sudworth gives only northern California coast for distribution. 22). Van Dersal, Nat. Woody Pl. U. S. 114. 1938, in part. *C. pygmaea* Sarg. is listed as a synonym. 23). McMinn, Ill. Man. Calif. Shrubs 41. Fig 11. 1939, in part, as to the Monterey reference.

CUPRESSUS GOVENIANA var. *ATTENUATA* Carr., *Traité Gén. Conif.* ed. 2. 172. 1867. Supposedly based on *C. attenuata* Gord., which I consider as a synonym of *C. Macnabiana*, which see. Carrière must have had a form of *C. Goveniana* in mind, for he could hardly confuse the two species. 2). Dalli. & Jacks., Handb. Conif. 198. 1923. "Branchlet systems more loosely arranged than in the type, the ultimate divisions very slender."

CUPRESSUS GOVENIANA var. *PENDULA* Elwes & Henry, *Trees of Great Brit. & Irel.* 5: 1171. 1910, seemingly the authors of this variety. 2). Dalli. & Jacks., Handb. Conif. 198. 1923. "A shrub with long, pendulous branchlets, the leaves often spreading and sharp-pointed; probably a transition form between the juvenile and adult stages."

CUPRESSUS GOVENIANA var. *VIRIDIS* Carr., *Traité Gén. Conif.* ed. 2. 172. 1867.

CUPRESSUS CALIFORNICA Carr., *Traité Gén. Conif.* 127. 1855. *Juniperus aromatica* Hort. aliq. is listed as a synonym. "Habite la californie. Introduit de graines en 1847."

CUPRESSUS CORNUTA Carr., *Rev. Hort.* 250. Fig. 32. 1866. "Cette plante, très-remarquable, existe dans le jardin de M. Denis, A. Hyeres (Alpes-Maritimes), où j'ai eu occasion de l'étudier." Carrière considered this plant an intermediate form between *C. Goveniana* and *C. Lambertiana* (really *C. macrocarpa*). His Fig. 32 shows three ovulate cones each with but four well developed scales with extremely long horns. The foliage is rather coarse for typical *C. Goveniana*. Perhaps, Carrière was right in assuming this plant to be a hybrid between the above mentioned species, but there is probably no way in which this assumption could now be proven, as it is extremely unlikely that any of the material of *C. cornuta* is still alive. 2). Gord. & Glend., *Pinet.* 3rd ed. 102. 1880. These authors call this the "Horn-Scaled Cypress" and state that Professor Parlatore considers it a monstrous form of *Cupressus Goveniana*.

14. *Cupressus Abramsiana*—Santa Cruz Cypress

CUPRESSUS ABRAMSIANA C. B. Wolf, species nova. Erect, densely branched tree up to 10 m. high, of symmetrical, pyramidal shape, equally broad at base, trunk well clothed with branches nearly to ground, main trunk not over 5 dm. in diam. at 1 m. from the ground, central leader straight with fairly thin gray bark broken into vertical strips or plates, or fibrous and shreddy. Larger branches 8 to 10 cm. in diam. and standing at right angles to trunk, but, when small, pointing upward at an acute angle. (A lower branch 7 cm. in diam. was 20 years old.) Foliage a rich light bright green; branchlets disposed on all sides of branches and either opposite or alternate, those of the season 10 to 15 mm. long, 1 to 1.5 mm. thick and persisting for several years. Leaves acute but blunt-pointed, about 1.5 mm. long, slightly narrower, well imbricated and forming slightly 4-sided branchlets. At first, the leaves show no sign of dorsal pit, but soon develop an inconspicuous, oval, closed pit or gland (apparently never functional). Older leaves, especially those on vigorous shoots, become greatly elongated and may be as much as 10 to 15 mm. long, 3 to 4 mm. wide and have a 2 to 4 mm. long acutely-pointed spreading tip. These soon become brown and are pushed off by the growth of the twig. Staminate cones produced in abundance at ends of branchlets which are slightly thicker and have leaves more imbricated than vegetative branchlets; at maturity they are 3 to 4 mm. long, 2 mm. thick, slightly 4-sided and are usually composed of 12 scales (10 to 16). Largest scales nearly 2 mm. broad, about as wide, their margins fimbriate; lower and upper scales usually bear 4 pollen sacs, while central or middle ones bear 5 or 6. Ovulate cones produced at tips of short branchlets which are even thicker and bear more closely imbricated leaves than staminate or vegetative branches. At first, these appear as blunt, enlarged structures a little over 2 mm. thick. Later the scale leaves spread apart exposing numerous ovules for pollination, after which they close and the cone develops to about 10 mm. in diam. the first season, being well rounded but not as thick as long. Scales usually 8 or sometimes 10; but, when 10, the 2 basal scales are usually very small. Umbos rather broad and narrow, about 2 mm. high, usually remaining green longer than the rest of the scale. During the second season the scales become a rich lustrous brown, the umbos are less conspicuous and appear only as broad raised central humps about 4 mm. broad. The stalk or branch bearing the mature cones is about 10 mm. long, 3 to 4 mm. thick and usually bears the remains of several dead leaves. At maturity the cones are nearly spherical, or elongate, but the face of each scale is somewhat flattened, the entire cone about 20 to 30 mm. long. The average cone contains about 62 seeds, these angular but somewhat flattened, 3 to 5 mm. long, slightly narrower, with a narrow hard

wing, the surface of the body a little rough or echinate due to the minute raised pitch pockets, brown and slightly glaucous or merely brown and a little shiny; hilum conspicuous, very light tan, about 1 to 1.5 mm. or even 2 mm. long. Cotyledons 3 to 4, occasionally 5, about 10 mm. long, linear, but a little flattened and with an acute but blunt and spineless tip. The next seedling leaves are slightly shorter and minutely spine-tipped.

Erecta, conferte ramosa ad 10 m. alta, habitu regulari, pyramidalis. Foliis laete viridibus abrupte acutis, ca. 1.5 mm. longis, latitudine paulo minoribus, bene imbricatis, ramulos 4-gonos efformantibus, fovea vel glandula dorsali inconspicua. Foliis adultis majoribus ad 10-15 mm. longis, 3-4 mm. latis, apice patenti acuto 2-4 mm. longo. Amentis staminatis numerosis, ramulis fultis quam vegetativis crassioribus, maturis 3-4 mm. longis, 2 mm. crassis, squamis pro more 12 (10-16), maximis 2 mm. latis, margine fimbriatis, infimis supremisque thecis 4 pro more praeditis, medianis 5-6. Strobilis ovulatis primo truncato-dilatatis ca. 2 mm. crassis, squamis ovula multa ferentibus, anthesi peracta strobilo primo anno ad 10 mm. crasso, maturo ad 20-30 mm. longo, subsphaerico, seminibus ad 62, 1-1.5 vel ad 2 mm. longis. Cotyledonibus 3-4, raro 5 ca. 10 mm. longis.*

Type Locality

Santa Cruz Mountains, Santa Cruz County, California, on the southwest slope of Ben Lomond, a mountain 7/10 mi. east of the Bonnie Doon School, elevation 1600 feet, in the Arid Transition Life Zone in association with *Pinus ponderosa* and *P. attenuata*, *Quercus Wislizenii* var. *frutescens* and *Haplopappus ericoides* subsp. *Blakei*, growing in white sand. Type specimen in the Rancho Santa Ana Botanic Garden Herbarium, sheet No. 17646, collected by Carl B. Wolf, Collection No. 6235 (*Propagation* No. 2185), November 9, 1934.

This species was named in honor of Dr. L. R. Abrams, Emeritus Professor of Botany and Director of the Natural History Museum of Stanford University, author of an Illustrated Flora of the Pacific States, a Phytogeographic Study of the Trees and Shrubs of Southern California, author of *Cupressus nevadensis*, one of the most beautiful of the California species, and a member of the Advisory Board of Rancho Santa Ana Botanic Garden. In 1937 Dr. Abrams examined and studied the cypress trees with me at Bonnie Doon.

Range

Cupressus Abramsiana, as here delimited, is known only from the Santa Cruz Mountains, California, where I have studied and

*Latin description by Dr. Leon Croizat, Arnold Arboretum, Harvard University.

collected it near Bonnie Doon, on the southwest slope of Ben Lomond, and at Eagle Rock at the northwest end of the same mountain. Specimens of a cypress have been collected on Butano Ridge, San Mateo County, located only a few miles to the north of Eagle Rock, but thus far I have been unable to relocate the growing trees and only tentatively include them under this species.

Localities

1. Bonnie Doon, Santa Cruz Mts. The stand of cypresses is located about 7/10 mi. east of the Bonnie Doon School. This area is only about 4 miles airline from the ocean and is easily reached by a road which turns inland from the coast highway (Calif. State Highway No. 1) about 2 miles south of Davenport, Santa Cruz County. The trees grow at an average elevation of about 1600 ft. in a white sand, associated with *Pinus ponderosa* and *P. attenuata*, *Quercus Wislizenii* var. *frutescens*, *Haplopappus ericoides* subsp. *Blakei* and *Arctostaphylos* spp. The stand of cypresses is rather limited, forms no grove or thickets, probably does not extend for more than a mile in any direction, and at the most consists of only a few hundred trees.

The Bonnie Doon area is typical Arid Transition Life Zone, despite its proximity to the ocean, and its climate is markedly different from that of the Redwood forests which are only a few miles away. For example, during the summer months when the adjacent coastal areas are bathed in fog almost nightly and for a large part of each day, the Bonnie Doon area is entirely above the fog. In the winter months it receives considerable rain and the average annual precipitation is in excess of 30 inches.

The lack of old trees and the uniformity of the stand at Bonnie Doon suggests that this area was subject to a fire in the not too distant past, for there are no trees over 10 m. high, and none has developed the really rough, fibrous bark which is present on old trees at Eagle Rock.

Collections:

a). M. E. Jones 2355, July 4, 1881, (Pom.), labelled at Santa Cruz, but probably this locality. Dr. P. A. Munz of Pomona College has kindly permitted me to examine Jones' diary for the period during which he made this collection. From it I learned that he stayed in Santa Cruz, but "botanized in the mountains with Anderson" on several different days. The "Anderson" must have been C. C. Anderson, who was familiar with the region, and who would most certainly have taken a visiting botanist to Ben Lomond, which outside of the Redwood forests was the most interesting botanical area adjacent to Santa Cruz. b). W. R. Dudley, March 30, 1899 (Dudl. Herb.). c). R. S. Ferris 2002, May 2, 1920 (Dudl. Herb.). This

specimen has a good photograph of the species attached. d). *H. L. Mason*, March 28, 1922 (Dudl. Herb.). e). *C. B. Wolf*, Coll. No. 6235, (Prop. No. 2185), November 9, 1934 (Type Set, widely distributed). From a tree 10 to 11 m. high, 10 m. in spread, with a dense and shapely pyramidal crown, the branches extending nearly to the ground, trunk about 5 dm. in diam. at 1 m. and with a smooth gray bark. At the time I made this collection, I had gone there under the impression that it was a station for *Cupressus Sargentii* and wrote the following field notes: "The trees are scattered, are mostly symmetrical, very thrifty appearing. In many ways they suggest *C. macrocarpa* (young trees). In cones they suggest *C. Goveniana*, but in any event seem very different from other stands of *C. Sargentii*." It was not until after later studies in the field and herbarium that I concluded that the Bonnie Doon cypresses were neither *C. Sargentii* nor *C. Goveniana*, but a new species. Seeds of this collection are highly glaucous. A wood sample taken from one of the nearly horizontal spreading lower branches at less than 1 m. above the ground, is 7 cm. in diam. and has about 20 annual rings, indicating that the tree grew rapidly. f). *C. B. Wolf*, Coll. No. 6236 (Prop. No. 2186), November 9, 1934. From a tree 6 to 7 m. high, with 6 m. spread, and a trunk 2.5 dm. in diam. at 1 m. A symmetrical tree with a dense crown, like Coll. No. 6235, but smaller. Seeds not glaucous. A wood sample taken from one of the lowest horizontally spreading branches at less than 1 m. above ground is 7 cm. in diam. and has approximately 20 annual rings. This suggests that both Coll. Nos. 6235 and 6236 are approximately the same age, despite their great variation in height.

2. Eagle Rock, Santa Cruz Mts., Santa Cruz Co., California. This locality is at the northwest end of Ben Lomond at an elevation of about 2500 ft. It is approximately 8 miles airline from the Bonnie Doon cypresses, and is reached by driving out to the extreme north end of the road known as the Empire grade, to the Locatelli Ranch, at the foot of Eagle Rock. There is a fire lookout station at the summit of Eagle Rock. All of the cypresses appear to be restricted to the southwest slope between the lookout station and the Locatelli vineyards at the base less than a quarter of a mile away. There are probably not over 50 cypresses in this locality, of which the largest are not over 7 or 8 m. high. One clump of rather stunted trees appears to be older than the others. These have trunks with long strands of gray-brown fibrous bark of which some layers can be pulled off rather easily, but do not leave a smooth surface beneath. According to Mr. Locatelli, who has lived in this area for nearly half a century, there was once a considerable stand of cypresses on this slope from which he cut a great many timbers for his barns and other buildings. However, about 1905, a severe fire burned over

this area; and, not only destroyed most of his ranch, but the cypresses as well.

The Eagle Rock cypress trees are associated with *Adenostoma fasciculatum*, *Ceanothus cuneatus* (in a broad-leaf form), *Pinus attenuata*, *Quercus chrysolepis*, and *Dendromecon rigida*, all of which are well suited to the granite and decomposed granite of this steep southwest sloping hillside. According to Mr. Locatelli, the rainfall averages from 50 to 80 inches per year, but the nature of the slope on which the cypresses grow prevents the accumulation of much water, and by summer it is dry and hot.

Several years ago I was informed that there were cypresses on Eagle Rock, but I cannot recall the source of my information. In 1942 Mr. Robert E. Burton of Santa Cruz, California forwarded me a small specimen in a letter confirming my earlier information. However, since Mr. Burton's specimen was badly smashed in the mail, I was still puzzled as to where to assign it and determined to visit the locality upon the first opportunity.

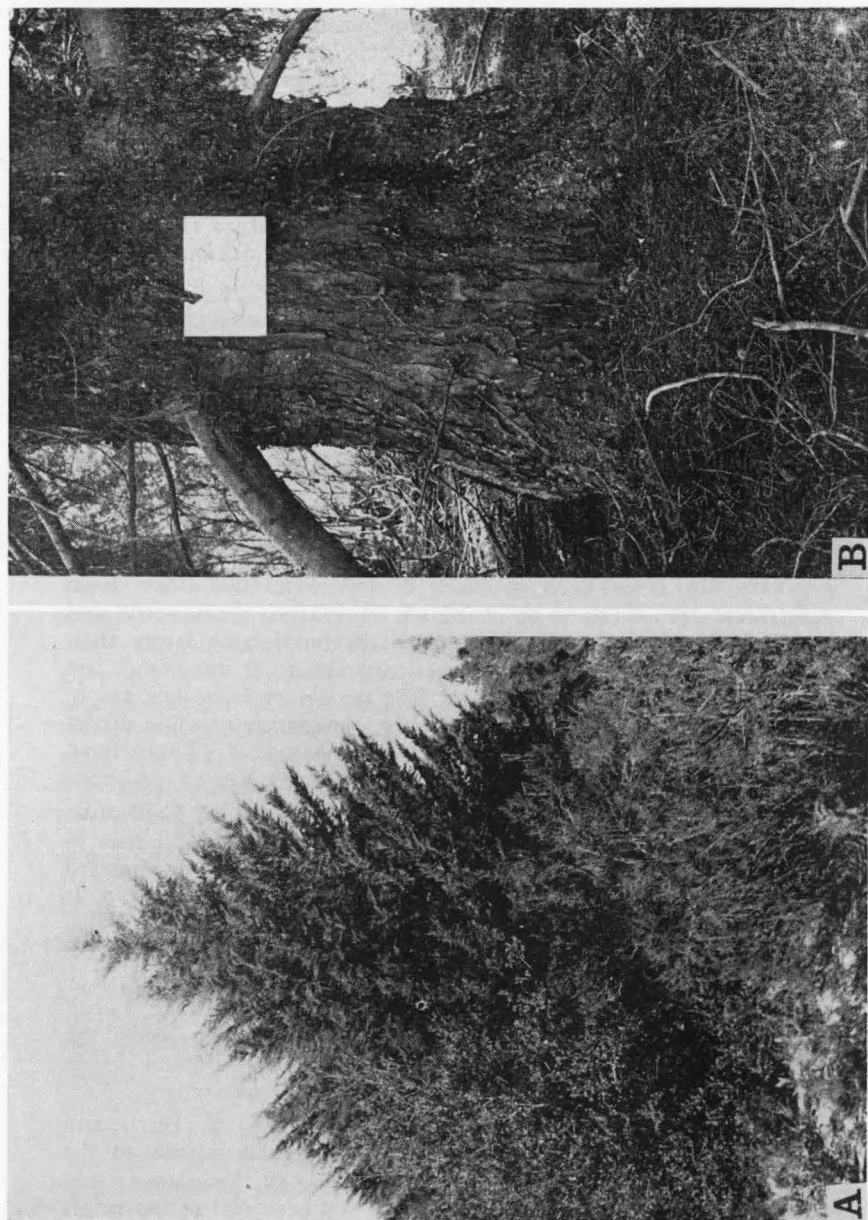
Collection:

C. B. Wolf, Coll. No. 11441 (Series A to P), Prop. No. 4910, February 20, 1943. Each specimen of this series was taken from a different tree to show the variation in foliage, cones, seeds and bark. Ovulate cones in this collection are considerably larger than those from Bonnie Doon; the largest are about 30 mm. long, less in width and usually have 10 scales. The seeds vary from light tan to dark brown; some appear to be strictly non-glaucous, while others are a little glaucous; none are as glaucous as No. 6235 (Type) from Bonnie Doon.

3. Butano Ridge, Santa Cruz Mts., San Mateo Co., California. This ridge lies from 5 to 10 miles north of Eagle Rock and rises to an elevation of about 2000 ft. Much of the ridge is sparsely covered with a mixed growth of *Pinus attenuata* and *Arctostaphylos* spp. It is roughly 6 miles long by 1 to 2 miles wide, and is largely inaccessible by road. There seems to be no question but that cypresses once grew in this area, for in the Dudley Herbarium are two specimens: The first is W. R. Dudley, labelled from ridge between Pescadero Creek and Butano Creek (also in Pomona), fine foliage, big seeds; the second is Hubert Jenkins, July 27, 1903, labelled from Butano Creek. Seeds of the latter collection are glaucous and the cones are large.

On November 13, 1934, along with Mrs. R. S. Ferris and Dr. W. W. Wagener, I walked over a considerable portion of the northern end of the ridge, gaining access by way of Pescadero Creek. A few days later I explored a part of the southern end of the ridge, by driving out to the north end of the China grade. In neither instance was I successful in locating any cypresses.

On October 18, 1944, I was able to spend part of a day exploring

FIGURE 36. *Cupressus Abramsiana*.

the Butano Creek area for cypresses. On Little Butano Creek I met Hans F. Carlsen, who has lived in the area for many years. He informed me of a road leading up the ridge between Little Butano Creek and Big Butano Creek. I was able to drive up this road for several miles into areas of Knob Cone Pines and manzanitas. The end of the passable portion of this road was near the main Butano Ridge. Even with careful scrutiny of the surrounding slopes by means of a small telescope, I was unable to locate any cypresses. There is a settlement consisting of summer cabins on the Big Butano Creek below which the vegetation is largely a typical Redwood Forest. Lack of time prevented me from exploring the upper part of Big Butano Creek. Under date of Nov. 30, 1944, Mr. Carlsen has written me stating that a friend of his who was born nearby told him that cypresses grow on the North Fork of Big Butano Creek. This information tends to substantiate the Jenkins collections from Butano Creek; but, until adequate specimens are available, or I am able to visit the living trees, I am still hesitant about the real identity of the Dudley and Jenkins specimens.

Thus, after forty years the exact location of the Butano Ridge cypresses remains unknown, and I refer the Dudley and Jenkins specimens to *Cupressus Abramsiana* with considerable hesitancy, but believe they more properly belong here than in *C. Sargentii*.

Collections of Cultivated Specimens

P. C. Everett, Coll. No. 7807, May 19, 1936; seedlings of Prop. No. 2186, from 4 in. pots in Garden nursery, seed flats planted March 28, 1935; about 20 cm. high, with juvenile spreading leaves and cotyledons still present; root system rather scanty.

Relationships

I regard *Cupressus Abramsiana* as a species somewhat intermediate between *C. Goveniana* and *C. Sargentii*, but probably somewhat more closely related to the former species. It resembles *C. Goveniana* in its slender bright-green branchlets and its clusters of ovulate cones. Its large seeds which are often glaucous are a characteristic of *C. Sargentii*.

The principal reason that I concluded that these cypress trees from Bonnie Doon, Eagle Rock, and perhaps also from the Butano Ridge should be described as a distinct species, was not because of

FIGURE 36.

CUPRESSUS ABRAMSIANA—Santa Cruz Cypress.
Bonnie Doon, Santa Cruz Mts., Santa Cruz Co., Calif. Coll. No. 6235 (Prop. No. 2185).

A—Type tree, 10-11 m. high. Photo Sept. 17, 1937 (type specimens obtained in 1934). Neg. No. 4346.

B—Trunk of same tree. The white card is 10 x 15 cm. Photo Nov. 9, 1934. Neg. No. 3499.

outstanding characters which made them easily separable, but because including them under species already described would result in confusion and possibly necessitate further consolidations. In other words, I concluded that failure to recognize *Cupressus Abramsiana* as a separate species would make it impossible to retain *C. Sargentii* as distinct from *C. Goveniana*. Then too, *C. pygmaea* should be reduced to *C. Goveniana*. Thus, *C. Goveniana* would again include nearly everything it did in Englemann's treatment in Brewer and Watson's Botany of California in 1880. Furthermore, consolidation of this sort in this group of species could not be done consistently without making somewhat similar consolidations elsewhere in the genus, such as placing *C. montana*, *C. nevadensis*, *C. Stephensonii* and *C. glabra* under *C. arizonica*, and *C. Forbesii* under *C. guadalupensis*.

References

CUPRESSUS GOVENIANA Mast., Journ. Linn. Soc. 31: 346. 1896, in part, as to the specimen cited from Santa Cruz (*Marcus Jones* 2355). 2). Elwes & Henry, Trees of Great Brit. & Irel. 5: 1171. 1910, in part, as to distribution in Santa Cruz Mts.

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15. *CUPRESSUS SARGENTII*—Sargent Cypress

Cupressus Sargentii Jepson, Fl. Calif. 1: 61. 1909. A slender or bushy tree, usually 10 to 15 m. in height, but sometimes over 25 m. high, the main trunk usually straight, and the crown either narrow or, in low trees on windswept areas, very much broader than high, the main branches joining the trunk at a broad angle (often nearly at right angles), the ultimate tips then usually slightly drooping, trunks rather thick for the height of the trees, sometimes nearly 1 m. in diam. at a like distance from the ground, the bark gray or dark brown or even almost black, thick and fibrous, sometimes 3 cm. thick, usually splitting into longitudinal strands; larger branches usually with a dark brown or grayish smooth bark, or occasionally a little reddish. In aspect, the trees of this species are never a rich bright green, but are a dull green, as if a bit dusty, or sometimes are distinctly a gray-green (although in comparison to the gray or glaucous species, these would never be considered as gray-foliaged); the color of the foliage varies considerably from tree to tree and, at different seasons of the year, because of the variation in the amount of bloom on the leaves. The branches bearing leaves and those of small size (1 to 2 cm. in diam.) are comparatively stiff and harsh (not soft and flexible as in species such as *C. Forbesii*), even the new vigorous growth is usually stiff. Ultimate branchlets of the season opposite or alternate, disposed on all sides of the branches, generally only 5 to 10 mm. long, frequently over 2 mm. thick and seldom less than 1.5 mm. thick, usually rounded or a little 4-sided. Leaves nearly 2 mm. long, equally broad, only slightly acute, the tip a little blunt, the margins not at all conspicuously ciliate or fimbriate even under a lens (10.5x); in most instances, the rounded or slightly ridged back of the leaf early develops a small dark dorsal pit which is not always evident on new leaves and on old leaves is only rarely functional (that is, exudes resin). This feature varies throughout the range of the species and from specimen to specimen, even from the same locality and seems to be of little merit for use in distinguishing any geographical entities within the species. On vigorous shoots the leaves elongate and may become 5 to 10 mm. long, 3 to 4 mm. wide and have a spreading and acute tip 2 to 3 mm. long; on such leaves, especially after they have turned brown, the dorsal pit is usually considerably distended with clear pitch or resin, but does not appear to exude pitch unless broken. In age, as these old and elongated leaves are pushed off, they are torn irregularly longitudinally but usually remain in one piece because of their fibrous nature. Staminate cones generally produced in great profusion, often giving large portions of the trees a yellowish cast. The branchlets bearing the staminate cones are seldom over 5 mm. long (usually only 2 or 3 mm. long), slightly thicker than the vegetative shoots and have their leaves a bit more

congested. Staminate cones 3 to 4 mm. long (occasionally up to 5 mm. long), about 2 mm. thick, angular, 4-sided or even more or less cylindrical with a blunt apex (much more like the cones of *C. Forbesii* and *C. Goveniana* than like those of *C. Macnabiana*), the scales usually 10 or 12, but sometimes as few as 6 or as many as 16, each about 2 mm. long, bearing 3 or 4 pollen sacs. Ovulate cones arising at tips of stubby branchlets often only 4 to 5 mm. long, but usually thicker than the staminate or vegetative branchlets. In early stages the cones appear merely as thickened ends, but soon enlarge to 3 or 4 mm. in diam., at which time the scales spread apart, and the numerous ovules at their bases are exposed for pollination. During the first season the cone scales change from green to brown, and the cone attains a diam. of about 10 mm. The second season the cones continue to enlarge, and their surface changes from a rich glossy brown to a dull brown or gray, and the surface is somewhat roughened because of the pitch pockets just beneath. Mature cones vary from as small as 15 mm. in length to over 30 mm., but are generally around 20 to 25 mm. long and may be nearly spherical, or elongate and bear inconspicuous umbos, or these may be 3 to 4 mm. high and conspicuous. Scales 6 to 10, but mostly 6 or 8, very occasionally only 4 (but such cones are somewhat abortive). An average 8-scale cone has over 100 seeds, these angular or flattened, the largest 5 to 6 mm. long, sometimes equally broad, dark brown, but glaucous, at least on the body, although sometimes only faintly so (inner surfaces of the scales are also glaucous); marginal wing thin, 0.5 to 1 mm. broad, or even nearly 2 mm. broad; hilum about 1 mm. long, very light tan (nearly whitish), usually conspicuous. Cotyledons 3 or 4 (mostly 4 and rarely 5), up to 20 mm. long, linear, only slightly flattened but mostly nearly terete and with a blunt point. The next leaves are in whorls of 4, usually less than 10 or 12 mm. long, flattened, linear and spine-tipped. The later leaves are gradually shorter, and in the second or third year transitional stages to the mature leaves are formed.

Type Locality

"Dry mountain slopes: Mayacamas Range, W. L. J. no. 3027 (type)." Jepson, Fl. Calif. 1: 61. 1909. The type specimen is in the Jepson Herbarium, Berkeley, California, and is labelled as follows: "Red Mountain, Mayacamas Range, southeastern Mendocino County, c. 3000 ft. June 17, 1908. W. L. Jepson, no. 3027."

The following notes regarding *Cupressus Sargentii* and Red Mountain were supplied by Dr. W. L. Jepson under date of August 3, 1943: "Red Mountain reaches an altitude of about three thousand feet and is, from the southwest, a fairly prominent landmark in the

Mayacamas Range of southeastern Mendocino County. *Cupressus Sargentii* is abundant on the summit and on the east and north slopes near the summit, and is only less abundant on the west slopes. The stand covers, perhaps, a thousand acres, maybe more. This species is a fairly typical fire-type conifer. Chaparral fires run over the range at intervals. A zone or strip of the cypress that has been destroyed by fire is resown with its own seed which are held in the closed cones for long periods. Germination is prompt and abundant and results in a new stand of mostly uniform height and density. Areas of the cypress two feet high join by a sharp line an area of trees fifteen feet high, or perhaps on another side are margined by a stand seven to ten feet high. There is, therefore, a sort of stratification of the colonies of various ages. Even if fires return at short intervals extermination would not be brought about since small canes five or six years old produce cones within one foot of the ground, always within a less period than the minimum fire interval.

"Over most of the mountain the cypress is a dominant or it is a co-dominant with *Arctostaphylos mariposa*. Where the stand is thin an apparent attempt to form cover results from the production of long lower branches.

"Some areas on the mountain contain rather old trees. One tree 18 feet high measured 17 inches in trunk diameter at one foot above the ground. Another tree 15 feet high had a trunk 8 inches in diameter at one foot. Sometimes one finds small compact islands of old trees in the midst of a young stand. In some areas the old trees become flat-headed at about 11 or 12 feet.

"Cones are sometimes produced in great abundance—a cluster may be very dense and half as big as a bushel.

"The dark brown bark is often roughly fissured into narrow ribbons one-half inch wide which run upward mainly by a right-hand spiral.

"The broken shale-like rock of the summit of the mountain seemed to be the same as the rhyolite tuff of Eocene age on which *Arctostaphylos myrtifolia* occurs in the Sierra Nevada foothills near Ione."

This species was named in honor of Dr. Charles Sprague Sargent (1841-1927), who organized the Arnold Arboretum and served as its director from 1872 until his death in 1927. His interest in the trees of North America was evidenced by his elaborate *Silva of North America* and many other works.

Range

United States. California. A species strictly confined to the Coast Ranges from extreme northern Mendocino County on Red Mountain near Cummins, and Cooks Springs, Colusa County, south

through Lake and Napa Counties to Sonoma and Marin Counties; thence, reappearing on Cedar Mountain, Alameda County; Santa Lucia Mountains from the Los Burros Mine, Monterey County, south to Cherro Creek, San Luis Obispo County; and an isolated grove near Zaca Peak in the San Rafael Mountains, Santa Barbara County.

Throughout the greater part of its range, *Cupressus Sargentii* is a species of the Upper Sonoran Life Zone and is frequently associated with *Pinus Sabiniana*, *Ceanothus cuneatus*, *Quercus dumosa* and *Quercus durata*. However, in a few places the species is definitely on the border of the Transition Life Zone as at Camp Meeker and Occidental, Sonoma County, where it is associated with *Pseudotsuga taxifolia*, *Sequoia sempervirens* and *Arbutus Menziesii*. Almost without exception, *Cupressus Sargentii* occupies rocky slopes or ridges, most frequently being serpentine formations or outcrops. In some areas the trees form isolated but rather conspicuous and fairly dense groves, while in other places, particularly in Lake and Napa Counties, the trees are scattered over the brushy hills very much in the same sparse pattern characteristic of *Pinus Sabiniana*, only much less abundant.

Occasionally the trees grow on the slopes of canyons or ravines and, where on a northeast or slightly protected slope, grow to fairly large size and are especially straight and tall. Trees on exposed habitats, as on Mt. Tamalpais, Marin County, are dwarfed but still generally develop a straight central trunk.

The rainfall for most of the areas where *C. Sargentii* grows averages around 25 inches per year, but this occurs during the winter months, and from May until October there is seldom more than an occasional thunder shower which normally would add only a fraction of an inch of precipitation, and which does little good to deep-rooted trees. Only in Sonoma and Marin Counties do the groves of *C. Sargentii* receive any moisture benefits from the summer fogs because in other localities they are well above the limits of fog.

Localities

1. Zaca Peak, San Rafael Mountains, Santa Barbara County. This station for *C. Sargentii* is the southernmost known locality and is in the San Rafael Mountains, Santa Barbara County and consists of an apparently single grove about a mile in extent east and west and, perhaps, less than one-half a mile north and south. The cypress trees occupy the summit and portions of the northeast slope of a long gentle ridge which lies about 3 miles east of Zaca Peak. This ridge is terminated by an abrupt dip into Manzana Creek Canyon. To reach the grove, a Forest Service Truck Trail from the Figueroa Ranger Station leads out to a ridge to the southeast of Zaca Peak, after

which a walk of perhaps 3 or 4 miles brings one to the long ridge on which the cypress trees grow. The average elevation of the portion of the ridge upon which the cypresses grow is about 3000 ft. The trees are confined to serpentine rock and although the higher slopes of Zaca Peak may be considered Arid Transition Life Zone because of the considerable stands of *Pinus Coulteri*, the cypresses are in the Upper Sonoran Life Zone with *Pinus Sabiniana* scattered through the surrounding chaparral, of which *Ceanothus cuneatus* is the most abundant member.

No attempt was made to count the number of trees in this grove on my visit to it on December 13, 1938, but there are, probably, not over one or two thousand trees in the entire grove. Of these, most are less than 7 m. high, but a few are about twice that height or around 16 m. Most of the trees were a dull dusty green in aspect, but a few were much more gray or glaucous.

This grove of cypresses first came to the attention of botanists early in 1935 when Mr. Maunsell Van Rensselaer, Director of the Santa Barbara Botanic Garden, distributed specimens collected by him on February 13, 1935 to Professors Jepsen of the University of California, Abrams of Stanford University, Munz of Pomona College, and to us at Rancho Santa Ana Botanic Garden. However, according to Van Rensselaer (*Trees of Santa Barbara*, 31. 1940), the grove has been known much longer, for he states: "Single 30-foot tree in the garden of Edgar B. Davison in Ballard, propagated from seeds collected by him in the San Rafael Mountains in 1908."

The nearest grove of *C. Sargentii* to the Zaca Peak station is on Chorro Creek, San Luis Obispo County, nearly 60 miles to the north. In view of this isolation plus certain morphological features, this Zaca Peak grove has been publicized as containing a new variety of *C. Sargentii*, and one newspaper account in Santa Barbara suggested that there were three kinds of cypresses in the area. To our knowledge, the name proposed for this supposedly new variety has never been properly published with a Latin description, formal diagnosis, figured or a type specimen designated and is, therefore, a *nomen nudum*.

The presence of dorsal pits on most of the leaves of the Zaca Peak material, and the active nature of some of them is the most conspicuous differentiation from many other collections of *C. Sargentii*, but I feel that these features are of little importance in this instance since they are not constant for all of the material in the grove. As to cone characters, some trees bear large cones with rather prominent horns and are, thus, like *C. Sargentii* var. *Duttonii* Jepsen, which is here reduced to synonymy.

Collections:

a). A series of 5 specimens collected by Maunsell Van Rensselaer on February 13, 1935 and deposited in Rancho Santa Ana Botanic

Garden under the letters A, B, C, D, E. These were forwarded to us shortly after their collection and may or may not represent material from different trees, but since they display a number of differences, they are discussed in detail as follows: "A". Many of the leaves, but not all, have dorsal pits, of which an occasional one is active. Ovulate cones rather large, the maximum being about 25 mm. long, slightly less in diam., or nearly globose and the umbos almost suppressed; seeds only lightly glaucous. "B". A large percentage of the young leaves are without dorsal pits, but most of the old ones have pits, none seem to be active. Ovulate cones rather small, mostly 15 to 20 mm. long with conspicuous umbos, especially those on the upper pair of scales. Seeds quite heavily glaucous. "C" Many of the young leaves have no dorsal pits; a few active pits noted on some of the old leaves. Ovulate cones with umbos only about 2 mm. high; seeds heavily glaucous. "D". Most leaves with dorsal pits, many of which are active. Ovulate cones more or less globose, about 20 to 25 mm. in diam., the umbos very low. Seeds only lightly glaucous. "E" Most leaves with visible dorsal glands, but only an occasional one active. Ovulate cones 20 to 25 mm. long, globose or slightly elongate. The seeds only lightly glaucous. b). C. B. Wolf, Coll. No. 9473 (Prop. No. 3374, our Zaca Peak No. 1 Strain), December 13, 1938, from a tree 7 m. high, with 6 m. spread and a trunk nearly 3 dm. in diam. This collection was from a tree near the west end of the grove. Some young branchlets with leaves without dorsal pits, but most have dorsal pits, and active pits with whitish resin exuding are fairly common. The ovulate cones are mostly less than 20 mm. in diam., are nearly globose and have inconspicuous umbos; the seeds are only slightly glaucous. c). C. B. Wolf, Coll. No. 9474 (Prop. No. 3375, our Zaca Peak No. 2 Strain), December 13, 1938, from a tree about 7 m. high, 6.5 m. spread and a trunk 4 dm. in diam. This collection was made from a tree at the east end of the grove. A few of the smaller branches have reddish cherry-like bark, but the older bark is gray and fibrous or shreddy. Most leaves, but not all, bear visible dorsal pits, of which only an occasional pit is active.

2. Chorro Creek, San Luis Obispo County. The Chorro Creek locality for *C. Sargentii* is reached by driving about 4 miles northwest of San Luis Obispo on California State Highway No. 1 to what was formerly the California National Guard Camp, but which is now a regular United States Army Camp. Chorro Creek turns north into the southern end of the Santa Lucia Mountains just a short distance east of the main headquarters of the camp. By following up this creek for about 2 miles, the grove of cypress is reached. The trees are abundant on the south sloping hillsides in an area $\frac{3}{4}$ to 1 mile north and south and about $\frac{1}{2}$ mile east and west. Most of the trees are less than 10 m. in height, but a few are as much as 15 m. high. In recent years many trees have been cut, probably for fence posts.

Our observations in 1934 were that no fires had swept through the area in many years. There is not a great deal of variation in the general aspect of the trees, except that the few which are isolated have well developed crowns with branches nearly to the ground, while those which are crowded together have fewer branches and sparse crowns. There is, however, a great deal of variation in the cones, some trees producing cones with very prominent umbos, while others are nearly without umbos. The new cones are a rich chestnut-brown, but in age turn a dull gray-brown.

The Chorro Creek area is a typical serpentine rock formation of the Upper Sonoran Life Zone with *Yucca Whipplei* and *Ceanothus cuneatus* as the most abundant associated species. The stand of cypresses ranges from about 700 to 1000 or 1200 ft. in elevation. Immediately below the cypress grove, the valley slopes have a heavy black adobe (clay) soil on which the cypress do not seem able to establish themselves, nor do the other plants of the chaparral slopes. The average rainfall at the nearby town of San Luis Obispo is about 20 inches, although it is not unusual for 35 inches to fall in a single wet season. The cypress grove may receive slightly in excess of this average since it is at the base of a mountain.

Collections:

a). Alice Eastwood, No. 15114, May 17, 1928 (R. S. A., Calif. Acad.); some of the leaves of this collection have indistinct dorsal pits. b). C. B. Wolf, Coll. No. 6213 (*Prop.* No. 2167, our Chorro Creek No. 1 Strain), November 1, 1934, from a tree 10 m. high, with 8 m. spread and a trunk nearly 6 dm. in diam., with bark very dark gray and over 2 cm. thick; the cones produced in great abundance, the umbos not particularly pronounced, the leaves mainly without dorsal pits. c). C. B. Wolf, Coll. No. 6214 (*Prop.* No. 2168, our Chorro Creek No. 2 Strain), November 1, 1934, from a tree 10 m. high, nearly 12 m. in spread and with a trunk over 10 dm. in diam. From a tree in the open which had had its tip removed or broken many years ago and had since developed a very dense and broad crown. Its cones were unusually angular with extremely large and high umbos, some of which were over 5 mm. high and rose conically from near the margins of each scale. Most leaves were without visible dorsal pits.

3. Cypress Mountain, San Luis Obispo County. The Cypress Mountain station for *C. Sargentii* is located approximately 24 miles by airline northwest of the Chorro Creek station; and, as far as I have been able to determine, no stations for this species have been discovered in the intervening area. Cypress Mountain is an outstanding peak in the southern portion of the Santa Lucia Range and is approximately 2900 ft. in elevation. The grove of cypress is mainly on the northeast side of the mountain near its summit and essentially

occupies the ravines and draws which drain into Las Tablas Creek. To reach this grove most easily, one should go to the Mora Brothers' ranch just to the north of the Cambria to Paso Robles road (California State Highway No. 41). Their ranch is located about 2 miles west of the side road leading to Klau and Adelaida. From the Mora Brothers' ranch, a trail about 3 miles in length ascends to the summit of Cypress Mountain. The upper slopes of Cypress Mountain are strictly Upper Sonoran Life Zone with an open forest of *Pinus Sabiniana*. The grove of cypress is mainly in Section 12, Township 27 South, Range 9 East, Mount Diablo Meridian. The trees grow on serpentine rock outcrops.

With the exception of the finest trees on Cedar Mountain, Alameda County, this grove is by far the finest for the species. It is estimated that many trees are nearly 30 m. in height, and a few may exceed this figure. Many of these larger specimens have clean, straight trunks over 1 m. in diam. at the base and taper gradually for 10 or 12 m. to the first living branches. Collections from this grove were not taken from the largest trees because of the difficulty of climbing, but the two trees from which collections were made were splendid specimens.

It is not known what the rainfall on Cypress Mountain averages, but it is likely that it is considerably more than at San Luis Obispo and probably averages at least 30 to 35 inches per year. Although the cypress grove is not over 10 miles airline from the ocean, its high elevation places it well above the usual limits of the summer fogs, so that the summer climate is much more like that of areas to the interior than it is to areas a similar distance from the ocean but at low altitudes.

Collections:

a). C. B. Wolf, Coll. No. 6216 (*Prop. No. 2170*, our Cypress Mountain No. 1 Strain), November 3, 1934, elevation 2700 ft., in a ravine on the north slope of the mountain, from a tree nearly 25 m. high, 10 m. in spread and with a trunk slightly less than 1 m. in diam. at 1 m. above the ground; the bark surface was gray and had considerable growth of lichens upon it, but the under layers were a rich dark brown. The cones were mainly less than 20 mm. in length; the seeds only lightly glaucous; the leaves were essentially without dorsal pits. b). C. B. Wolf, Coll. No. 6217 (*Prop. No. 2171*, our Cypress Mountain No. 2 Strain), November 3, 1934, elevation 2850 ft., on the main ridge of the mountain, from a tree about 10 m. high, with 8 m. spread and a trunk about 8 dm. in diam., the dark gray-black bark with deep longitudinal fissures or furrows and at least 15 mm. thick. The cones are without especially prominent umbos, are mainly 20 to 30 mm. long, slightly less in diam. Leaves essentially without dorsal pits.

4. Pine Mountain, San Luis Obispo County. The Pine Mountain grove of cypress is about 11 or 12 miles northwest of the Cypress Mountain grove and is only 6 or 7 miles by airline from the ocean. It is situated at the northeast end of the Pine Mountain ridge on the slopes above Tobacco and Little Burnett Creeks at an elevation of approximately 2500 ft. The grove is situated largely in Section 27, Township 25 South, Range 8 East, Mount Diablo Meridian. Pine Mountain lies directly inland from the Hearst Ranch "Castle", but to reach it by road, one must go south about 9 miles to San Simeon Creek and take the road up the creek, which, after about 16 miles of driving, ends on the main ridge of Pine Mountain. The Diamond D Dude Ranch is a short distance to the northeast, but the road leading to it is too steep for many cars. A walk of about 1 mile to the northeast brings one to the Pine Mountain cypress grove, which is, perhaps, larger in extent than that on Cypress Mountain but does not contain large trees. For the most part, the trees are less than 10 m. in height, are on serpentine rocky slopes and are in the Upper Sonoran Life Zone, mixed in an open forest of *Pinus Sabiniana*. Pine Mountain summit is nearly 3600 ft. in elevation and has a considerable forest of *Pinus Coulteri*, an indication that the upper portion of the mountain is to be considered as Arid Transition Life Zone.

Collections:

a). C. B. Wolf, Coll. No. 6218 (*Prop.* No. 2172, our Pine Mountain No. 1 Strain), November 4, 1934, from a tree 10 m. high, with 7 m. spread and a trunk 3 dm. in diam.; cones 20 to 25 mm. long, the umbos not large; leaves mainly without dorsal pits.
b). C. B. Wolf, Coll. No. 6219 (*Prop.* No. 2173, our Pine Mountain No. 2 Strain), November 4, 1934, from a tree 8 m. high, with 6 m. spread and a trunk 3 dm. in diam.; cones small, only 15 mm. long, nearly spherical and many with only 4 scales; leaves mainly without dorsal pits. Despite the small cones and few scales, the seeds of this collection are larger than those of most other collections of this species, some being nearly 6 mm. long, equally broad and are mainly flattened and only lightly glaucous.

5. Los Burros Mine, Monterey County. The Los Burros Mine grove of *C. Sargentii* is the only known grove in Monterey County, but is only 20 miles north of the Pine Mountain grove in northern San Luis Obispo County. The grove is probably all within Section 1, Township 24 South, Range 5 East, Mount Diablo Meridian, and is at an approximate elevation of about 2500 ft. and lies on the southwest slopes of Alder Peak (3747 ft.) and to the east of the upper portions of Alder Creek. In years gone by it was necessary to come in by trail from Jolon to reach Krenkel's Ranch and the nearby Los Burros Mine, but with the completion of California State Highway No. 1 along the coast from San Luis Obispo to Monterey and a dirt road which leaves the coast just south of

Willow Creek (about 1 mile north of Cape San Martin), it is now possible to drive up to Krenkel's house and the Los Burros Mine, a distance of about 8 miles from the coast highway. The cypress trees can then be reached by walking less than one-half a mile. The Los Burros grove of cypresses is not extensive, and few of the trees are over 10 m. high. They all appear to be confined to a serpentine hillside and are mixed with an open forest of *Pinus Sabiniana*.

Collections:

a). C. B. Wolf, *Coll. No. 6220* (*Prop. No. 2174*, our Los Burros No. 1 Strain), November 5, 1934, from a tree about 11 or 12 m. high, with 9 m. spread and a trunk 5 to 6 dm. in diam. at 1 m. The cones average less than 20 mm. in diam. and have very low or inconspicuous umbos; the seeds are only slightly glaucous; only a few leaves have indistinct dorsal pits. b). C. B. Wolf, *Coll. No. 6221* (*Prop. No. 2175*, our Los Burros No. 2 Strain), November 5, 1934, from a tree about 10 m. high, 10 m. in spread and with a trunk 4 to 5 dm. in diam.; only a few leaves with indistinct dorsal pits; cones over 25 mm. long, with low and inconspicuous umbos. c). Herman L. Baer, September 18, 1938 (R. S. A.), on the headwaters of Villa Creek, from trees 5 to 6 m. in height, at an elevation of 2500 to 3000 ft. Mr. Baer describes the locality as a brushy hillside, and says the cypress made a fair-sized patch. This locality is adjacent to the Los Burros grove, and it may well be that Mr. Baer was actually on one end of the Los Burros grove, for Villa Creek is only a mile or so to the south of Alder Creek. On the other hand, it may well be that the cypresses are much more extensively distributed over this area than I have indicated above.

6. Cedar Mountain, Alameda County. This grove of cypress centers around the summit of Cedar Mountain, but extends well down from the main ridge and covers an area of at least 1000 acres, much of which is a rather dense stand of cypress trees constituting one of the finest areas for the species. The presence of cypresses on this mountain has long been known, for the United States Geological Survey Map of June, 1907, Tesla Quadrangle, used the term "Cedar Mountain" and "Cedar Mountain Ridge" to designate this portion of the Inner Coast Range Mountains. Dr. Engelmann (*Bot. Calif. 2: 114. 1880*) refers to cypresses on Cedar Mt., Alameda County. Cedar Mountain, Alameda County rises to a height of 3670 ft., the summit being Section 26, Township 4 South, Range 3 East, Mount Diablo Meridian, but the grove extends into several of the adjacent Sections, with the bulk of the trees occurring at elevations of between 2500 and 3000 ft. The Arroyo Mocho skirts the north and east base of Cedar Mountain, and closely paralleling this canyon is the road from Mount Hamilton to Livermore. From several points along this road, the extensive stands of cypress are easily visible on the northeast slopes of Cedar Mountain, but they

are most easily reached by driving approximately 5 miles south and east of Livermore on the Mount Hamilton road; at this point a private road leads off to the south and ascends to Cedar Mountain Ridge. After about 8 miles of driving on this road, the cypresses are reached after having passed up from open grassland to an open oak belt of *Quercus Douglasii* and eventually into scattered stands of *Pinus Sabiniana*, which also occur mixed with the cypresses. When the cypresses are first reached, there is a comparatively level ridge where deer hunters have made camp. Here the cypresses form a park-like grove in which many splendid specimens are present. On the adjacent northeast slopes, the trees are more crowded and are not nearly so well developed as individual specimens. Some of the finest trees are about 16 m. high, but a few attain heights of around 20 m. The soil of the area is a fine red rock which insures excellent drainage and opportunities for the cypress trees to reproduce by means of seedlings.

This grove forms the basis for *Cupressus Sargentii* var. *Duttonii* Jepson (1923); based on W. L. Jepson, No. 7441. This variety was founded largely on the large cones with prominent umbos and leaves mainly lacking dorsal pits. After carefully comparing these features with other collections of *Cupressus Sargentii*, it was concluded that they were not constant enough to warrant retaining *Duttonii* as a variety, especially since many of the trees on Cedar Mountain do not conform to the description of *Duttonii*, in that their cones are essentially without umbos and are not large.

Under date of March 10, 1943, Professor Jepson has written me the following biographical note concerning Dutton:

"Harry Arnold Dutton, a graduate of Stanford University with the class of 1900, went into business life as a vocation, but he loved always the fields and mountains and never lost a bent for botany developed in his undergraduate years under the inspiring influence of Professor William Russell Dudley. Some time after graduation he made his home at first in Berkeley. His continued interests in the native plant life brought him to my notice and we went together on a number of field expeditions: from Lake Tahoe to the Warner Mountains in eastern Modoc County where we climbed both Mount Bidwell and Eagle Peak; from Oceanside on the San Diego coast far eastward on a circuit through the Colorado Desert, spending many days of a favorable season in the San Felipe Valley and the Vallecito; from Berkeley to the central Sierra Nevada foothills in the springtime; and so on. Of field companions none surpassed Harry Dutton in his out-of-doors spirit, in his generous helpfulness and in unfailing good humor. These are qualities that commend a friend for a life-time. It was natural, therefore, that I asked him to go on a trip to Cedar Mountain in the Mount Hamilton Range. The early day concepts of our native species of *Cupressus* were naturally vague. Only two

species, mainly through cultivation, were at all well-known, namely *Cupressus macrocarpa* and *Cupressus macnabiana*, and most California material was referred to one or the other of these. Dr. Albert Kellogg of the California Academy of Sciences visited Cedar Mountain and called its cypress *Cupressus macrocarpa*. Professor Edward Lee Greene also spoke of the Cedar Mountain tree as *Cupressus macrocarpa*. I myself had been on Cedar Mountain May 17, 1891, and again on November 13, 1914, but still unsatisfied I asked Harry Dutton to join me in another trip. We reached the top of the mountain November 30, 1917, made a detailed study of the cypress grove, gathered abundant material and drove immediately to Cypress Point at Monterey in order that fresh comparisons could be made with the Monterey Cypress. It was my decision that the Cedar Mountain tree was not *Cupressus macrocarpa* but more nearly related to *Cupressus sargentii*. The name it received was, therefore, *Cupressus sargentii* var. *duttonii* in honor of my friend and companion on this wholly delightful journey."

Collections:

a). W. L. Jepson no. 7441, Nov. 30, 1917 (Jepson Herb., R. S. A.), Cedar Mt. This is the type set of *C. Sargentii* var. *Duttonii* and consists of several specimens. b). C. B. Wolf, Coll. No. 1802 (Prop. No. 1058), November 4, 1930, from a tree 15 m. high, with 8 m. spread and a trunk 5 dm. in diam., growing on the northeast side of the mountain near the summit. c). C. B. Wolf and E. R. Johnson, Coll. No. 6201 (Prop. No. 2157, our Cedar Mountain No. 1 Strain), October 19, 1934, from the same tree as the above (Coll. No. 1802), but the height now close to 17 m. The cones of this collection are of medium size and lack the prominent horns which are supposed to characterize variety *Duttonii*. d). C. B. Wolf and E. R. Johnson, Coll. No. 6202 (Prop. No. 2158, our Cedar Mountain No. 2 Strain), October 19, 1934, from a tree 14 m. high, with 8 m. spread and a trunk a little over 5 dm. in diam. at 1 m. This tree had large cones with prominent umbos and approximates the description for variety *Duttonii*.

7. Mount Tamalpais, Marin County. Scattered over the upper portions of Mount Tamalpais are several stands of cypress which have long been known. The highest peak is 2601 ft. in elevation and is a well known landmark in the San Francisco Bay region. For many years the mountain has been a mecca for botanists because on its slopes are many outstanding species, of which several have their type localities there. The upper slopes of Mount Tamalpais are clothed with a chaparral growth of *Arctostaphylos* spp., *Adenostoma fasciculatum* and *Ceanothus* spp. *Cupressus Sargentii* is known from several small groves not greatly distant from each other; and, apparently, all are restricted to serpentine outcrops.

The Mount Tamalpais trees of *Cupressus Sargentii* are of interest in that they are broad and squatty in proportion to their height, a feature which is characteristic of many plants found on exposed mountain tops. However, as discussed under the horticultural portion of this paper, both *Prop.* Nos. 252 and 2156 as grown from seed at Rancho Santa Ana Botanic Garden have retained this characteristic compact growth. The Mount Tamalpais trees and those from Occidental and Camp Meeker (two localities immediately to the north in Sonoma County) appear to be closely related genetically and have similar growth habit, but the latter in the wild are in much better areas so that they are larger.

The average rainfall just to the north of Mount Tamalpais is 47 inches per year, and it may be that on the higher slopes of Mount Tamalpais this figure is greatly exceeded, but due to the rocky soil and exposed habitat where the cypresses grow, little moisture is retained for the trees during the long dry summer. Due to the closeness of Mount Tamalpais to the ocean, there is considerable moisture in the air because throughout the summer months its lower slopes are more or less constantly bathed with fogs and moist air.

Collections:

a). J. T. Howell, *Coll.* No. 678 (*Prop.* No. 252), August 22, 1927, from Rock Spring Trail at 1800 ft. elevation, in rocky soil, 1 to 2 miles west of West Peak, from a tree 6 to 7 m. high and 10 to 13 m. spread. (This collection at Rancho Santa Ana Botanic Garden corresponds to J. T. Howell No. 3040 as found elsewhere). b). C. B. Wolf and E. R. Johnson, *Coll.* No. 6200 (*Prop.* No. 2156, our Mount Tamalpais Strain), October 18, 1934, from a tree about 7 m. high, of equal spread and with a double trunk, one fork of which was 3 dm. in diam., the other over 5 dm. in diam.; the cones 20 to 25 mm. long, almost without umbos; the leaves almost all without visible dorsal pits; this locality was approximately 2500 ft. in elevation and was 1.8 miles west of West Peak and, possibly, is from the same small grove as the Howell collection cited above. There is another much larger grove of *C. Sargentii* in which the trees form a dense stand; this grove is located a mile or two to the west and is easily visible from the road. c). J. A. Ewan, No. 10182 (R. S. A.), March 1, 1937, from San Geronimo Ridge at 1300 ft. elevation.

8. Occidental and Camp Meeker, Sonoma County. Collections of *C. Sargentii* from the vicinity of Camp Meeker and Occidental, Sonoma County appear to be from a single grove whose northwest boundary is about 2.8 miles northwest of Camp Meeker on the road to Monte Rio. The southeastern boundary is approximately 2 miles northeast of Occidental on the Coy Ranch. At both of these stations the trees are growing in serpentine. Although I am not certain that cypress occur between these two stations, I suspect that such is the case, but due to lack of time when making the collections in that area,

the intervening area was not explored (an airline distance of not over 2 miles). At both of these stations, the Life Zone is best considered as Humid Transition, for the surrounding trees are *Sequoia sempervirens*, *Arbutus Menziesii* and *Pseudotsuga taxifolia*. The cypress trees of this area probably receive greater winter rainfall (unless exceeded by those on Mount Tamalpais) than any other station for *C. Sargentii*; and, in addition, there is a greater amount of summer fogs or moist air.

The most interesting feature in regard to the Camp Meeker and Occidental grove of *C. Sargentii* is the dense, broad crowns present on many of the trees. This feature has been noted elsewhere for this species as a fairly constant feature only on Mt. Tamalpais. Like the trees grown from seed from Mt. Tamalpais, these trees retain their broad shape in cultivation. This characteristic broad growth sets the trees from these two localities apart from the other forms of *C. Sargentii*; but, after careful consideration, has not been regarded as of sufficient importance for segregating these plants under a separate subspecies, despite the fact that for horticultural purposes they are different.

Some botanists who have collected cypress from the Camp Meeker and Occidental area have distributed their specimens as *C. pygmaea*, *C. Goveniana* var. *pygmaea* or as *C. Goveniana*, but I consider this a wrong determination for the trees have all of the essential features of *C. Sargentii*.

Collections:

a). J. Clausen, No. 749 (R. S. A.), March 26, 1933, from a tree 8 to 10 m. high, at the summit of the Harrison Grade between Graton and Occidental; many of the leaves have visible dorsal pits; cones 15 to 18 mm. long, practically without umbos; seeds lightly glaucous, 4 to 5 mm. long, about as broad. b). C. B. Wolf and E. R. Johnson, Coll. No. 6183 (Prop. No. 2140, our Camp Meeker Strain), October 13, 1934, from 2.8 miles from Camp Meeker on the road to Monte Rio, elevation 200 ft., on a rocky (serpentine) south slope, from a tree 10 m. high, 12 to 13 m. in spread and with a trunk 7 dm. in diam at 3 dm. above the ground, the bark a very dark gray or almost black. The cones of this collection are mostly less than 20 mm. long, nearly globose and have very low umbos; less than one-third of the leaves have visible dorsal pits; seeds 4 to 5 mm. long, only slightly glaucous. c). C. B. Wolf and E. R. Johnson, Coll. No. 6184 (Prop. No. 2141, our Occidental Strain), October 13, 1934, from a serpentine outcrop on Coy's Ranch, about 2 miles from Occidental, elevation 300 ft., from a tree 15 m. high, 13 m. in spread and with two trunks of which the first was 7.5 dm. in diam., the second 1.3 to 1.6 m. in diam. at the ground. Foliage was somewhat finer than the other two collections and less than one-half of the leaves had visible dorsal

pits; cones about 18 to 20 mm. long, spherical or globose, nearly without umbos. This was a remarkable old tree that appeared to be over-mature. Its extremely large trunk diam. is not surpassed by any other specimen of this species known to me. The bark was 15 to 20 mm. or more in thickness and was very dark gray on the surface and a very dark brown beneath.

9. Inner North Coast Range area. The remainder of the distribution of *Cupressus Sargentii* north of San Francisco is entirely restricted to the Inner North Coast Ranges of Sonoma, Napa, Lake, Colusa and Mendocino Counties, with scattered groves and trees too numerous to be treated in the same manner as the preceding stations which were well isolated from each other. As mentioned under *Cupressus Macnabiana*, it is in this region that the two species grow together, both appearing to thrive under much the same conditions, although *C. Sargentii* is probably more successful, or is at least more vigorous.

During our travels of exploration in this region for cypress, we were interested in making collections from the numerous main stands or groves, but in the case of *C. Sargentii*, it was soon discovered that so many isolated trees were scattered over the hills that to record them all would be an almost impossible task. As a result, the collections cited and discussed below represent only the major localities for the species, and any ambitious collector could go into the region and add numerous stations.

Localities

1. Northeast base of Mt. St. Helena. This locality is on the Calistoga to Middletown road and is on the upper drainage system of St. Helena Creek, partly in Napa County and partly in Lake County. Scattered *Libocedrus decurrens* and *Pseudotsuga taxifolia* suggest that this canyon is in Arid Transition Life Zone, rather than Upper Sonoran, despite the fact that it is only about 1500 ft. in elevation.

Collections:

a). C. B. Wolf, No. 1507, February 25, 1928, Napa County at the Lake County line, from a tree 13 m. high and with a trunk 3.5 dm. in diam.; most of the older leaves and a few of the young ones with visible dorsal pits; cones nearly spherical with very low umbos, mainly 15 to 18 mm. or less in diam.; seeds only lightly glaucous. b). C. B. Wolf and E. R. Johnson, Coll. No. 6196 (Prop. No. 2152, our Mt. St. Helena Strain), from the same spot as C. B. Wolf, No. 1507, but from a tree 11 m. high, 8.5 m. in spread and a trunk 4 dm. in diam.; the bark very dark gray or almost black; most of the leaves with closed dorsal pits. c). Elmer I. Applegate, No. 6621 (R.S.A., Dudl. Herb.), March 25, 1931, from approximately the same spot as the

above collections, but from trees 16 to 25 m. high and with trunks 0.6 to 1 m. in diam.; almost all of the leaves with conspicuous dorsal pits. d). *Ira L. Wiggins*, No. 5571 (R. S. A., Dudl. Herb.), March 13, 1932, from 13 miles north of Calistoga on road to Lower Lake in Lake County. This location must have been in approximately same spot and same canyon as the three preceding ones. Only about one-half of the leaves have visible dorsal pits.

2. Pine Flat region, west slope of the Mayacamas Mountains, Sonoma County. This locality is not over 5 or 6 miles southeast of the Geysers in the northern part of Sonoma County.

Collection:

Elmer I. Applegate, No. 8859 (R. S. A., Dudl. Herb.), March 25, 1934. Only a few of the older leaves have visible dorsal pits; cones about 20 mm. long, nearly spherical, the umbos inconspicuous; seeds only lightly glaucous.

3. Aetna Springs, Napa County. Aetna Springs is located in northwestern Napa County. *C. Sargentii* is scattered over the serpentine hills of this region in the chaparral and with *Pinus Sabiniana*. Some of the trees are the typical dull green (dusty green) as is common for most of the plants of *C. Sargentii*. However, a few are much more glaucous and, for this reason, stand out from the rest.

Collection:

C. B. Wolf and E. R. Johnson, Coll. No. 6193 (*Prop. No.* 2149, our Aetna Springs Strain), October 16, 1934, from about 0.5 miles southwest of the quicksilver mine above Aetna Springs at about 1500 ft. elevation, from a tree about 15 m. in height, 8 m. in spread and with trunk 4 dm. in diam. Most of the leaves (except very young) have visible dorsal pits; cones 25 to 30 mm. long, slightly less in diam., the umbos very inconspicuous; seeds glaucous.

4. Butts Valley, Napa County. This area lies a few miles to the north of Aetna Springs and is along the road to Middletown, Lake County. Trees of *C. Sargentii* are well scattered throughout the area, especially on the rocky benches just above the creeks and ravines. We noted on October 16, 1934 that from near Aetna Springs to Middletown this species formed scattered stands, but in no place were there any compact groves.

Collections:

a). *J. T. Howell*, Coll. No. 690 (*Prop. No.* 266), August 24, 1927, from Butts Valley, Napa County, from a tree 12 m. high; only an occasional leaf with dorsal pits; some cones nearly 30 mm. long, slightly less in thickness; the umbos very pronounced, about 4 to 5 mm. high. (This collection at Rancho Santa Ana Botanic Garden corresponds to *J. T. Howell*, No. 3050 as found elsewhere). b). *J. T. Howell*,

Coll. No. 691 (*Prop.* No. 267), August 24, 1927, from the same spot as the preceding, but from a tree 20 m. high and with a trunk 6 dm. in diam.; many of the old leaves have raised dorsal glands instead of sunken pits, some of which when opened on dried specimens on August 8, 1942 still had liquid pitch inside; cones nearly globose, mostly 20 mm. long, nearly without umbos. (This collection at Rancho Santa Ana Botanic Garden corresponds to *J. T. Howell*, No. 3051 as found elsewhere). The above notation regarding the dorsal glands of the leaves of this collection indicates that it is certainly not a very great step from these glands which are normally closed, but filled with pitch, to those which open, as in the case of material of this species from Zaca Peak, Santa Barbara County.

5. Reiff, Lake County. Between Reiff Post Office, Lake County and the Napa County line a point about 1 mile west of the same, are fine stands of *C. Sargentii* mixed with *C. Macnabiana* (Coll. No. 6192). As in a number of other places in this region, the two species grow together; but, as far as our observations have gone, the two do not hybridize. For a more detailed discussion of this area, see the Reiff Area listed under *C. Macnabiana*.

Collections:

a). *C. B. Wolf and E. R. Johnson*, Coll. No. 6191 (*Prop.* No. 2147, our Reiff Strain), October 16, 1934, 1500 ft. elevation, from 1 mile west of Napa County line in Lake County on road to Reiff, from a tree 10 m. high, with 8 m. spread and a trunk 4.5 dm. in diam.; most old leaves and a very few young ones with visible dorsal pits; cones mostly about 20 mm. or less in length, the umbos not conspicuous. b). *J. A. Ewan*, No. 10,355A (R. S. A.), May 23, 1937, from 14.5 miles from Lower Lake on Monticello road, Lake County, in about the same locality as the above and has leaves and cones very similar.

6. Cobb Post Office, Lake County. Along the road from Middletown to Cobb Post Office, Lake County, is a rather extensive area or grove of *C. Sargentii*, the first trees of which are between 5 and 6 miles northwest of Middletown and extend along northwest for over 1.5 miles to a point 7.3 miles from Middletown. This is typically Upper Sonoran Life Zone with scattered *Pinus Sabiniana* and chaparral. However, a few hundred feet in elevation above on this same rocky road is a forest of *Pinus ponderosa*. The soil of this area is a rocky red clay, the altitude about 1800 to 2000 ft., with most of the cypress trees growing on the south slopes of the hillside.

Collection:

C. B. Wolf and E. R. Johnson, Coll. No. 6195 (*Prop.* No. 2151, our Cobb Post Office Strain), October 17, 1934, from 7.3 miles northwest of Middletown on road to Cobb Post Office, from a tree 11 m. high, with 8 m. spread and a trunk about 4 dm. in diam.,

its bark fully 2 cm. thick and a very dark gray or almost black; old leaves and a very few of the new with visible dorsal pits; cones up to 25 mm. long, nearly globose, the umbos inconspicuous; seeds heavily glaucous.

7. Pieta Road, Lake County. Pieta Road leads across the Coast Range Mountains from near Hopland to Kelseyville, via Highland Springs. The only area in which *C. Sargentii* is abundant (it is, perhaps, absent elsewhere in this area) is about 4.8 miles west of (above) Highland Springs at about 2000 ft. elevation. To the north of the road on a serpentine ridge on Bill Donald's Ranch, is an interesting open stand of *C. Sargentii* in which the individual trees are symmetrical and well developed. Across the road to the south is a hillside of, perhaps, 70 acres covered by a dense thicket of *C. Sargentii*, which from a distance looks like a bushy chaparral slope. The trees of this thicket are mainly about 7 to 8 m. in height. Bill Donald told us that this dense stand of cypress was a favorite refuge for deer since neither dogs nor man could successfully force them out. On this same road, but a short distance nearer to Highland Springs, is a colony of *C. Macnabiana*, for a description of which see notes on the Pieta Road station under that species.

Collection:

C. B. Wolf and E. R. Johnson, Coll. No. 6185 (Prop. No. 2142, our Pieta Road Strain), October 14, 1934, from a fine specimen tree to the north of Pieta Road, 12 m. high, with 10 m. spread and a trunk 4 dm. in diam.; most old leaves and a few young ones have visible dorsal pits; cones nearly globose, 20 to 25 mm. in diam., the umbos inconspicuous; seeds very glaucous (perhaps more so than for any other collection of this species). This collection very heavily laden with staminate cones, these somewhat angular, 4-sided, with 12 to 14 scales, many of these cones about 4 mm. long (rather large for this species).

8. Hough Springs, Lake County. This locality situated about 7 miles east of Hough Springs on the road to Williams or 3 miles west of the Colusa County line, is on a fork of Cache Creek. For a detailed account of this area, see the Hough Springs area under *C. Macnabiana* (Coll. No. 6187 was collected here). *C. Sargentii* seems to be rather localized in this immediate area but may well continue in scattered stands to the north to Cooks Springs, Colusa County.

Collection:

C. B. Wolf and E. R. Johnson, Coll. No. 6188 (Prop. No. 2145, our Hough Springs Strain), October 14, 1934, from a tree 9 m. high, with 6 m. spread and a trunk 3 dm. in diam., most of the old leaves and an occasional young leaf have closed dorsal pits; cones nearly globose, mostly less than 20 mm. long, with very low

inconspicuous umbos; seeds rather glaucous.

9. Cooks Springs, Colusa County. This is the extreme north-eastern known station for *C. Sargentii*; but is, in reality, not over 6 miles due north of the Hough Springs station. Cooks Springs are located on the upper portion of Indian Creek, and the trees of *C. Sargentii* are mainly confined to the areas close to the creek. There are many splendid straight trees in this canyon, both above and below the springs, some of which are well over 20 m. in height. The soil is red, rocky and the associated tree species is *Pinus Sabiniana*. The approximate elevation is 1800 ft.; the surrounding hillsides are largely covered with chaparral.

Collection:

C. B. Wolf and E. R. Johnson, Coll. No. 6189 (Prop. No. 2146, our Cooks Springs Strain), October 15, 1934, from a tree nearly 22 m. high, with 10 m. spread and a trunk about 8 dm. in diam. at 1 m. above ground and 6 dm. at 8 m. above the ground (a fine straight tree). Leaves with very inconspicuous dorsal pits or on some old leaves not visible; only a few young leaves have any at all; cones 25 to 30 mm. long, rather angular and with high umbos; seeds rather glaucous. The large cones with prominent umbos and the splendid growth size of some of the trees at this locality suggest the Cedar Mountain material.

10. Red Mountain, southeastern Mendocino County. This is the "Red Mountain" in the Mayacamas Range and according to a communication dated February 1, 1945 from R. W. Cummins, County Surveyor of Mendocino County: "An Army Engineer topographic sheet shows a 'Red Mt.' some five or six miles south-east of Ukiah, which is also shown on U. S. Land Office township plot for T. 14N, R11W, M.D.M." Due to misunderstanding about the location of this "Red Mt.", I have not visited it.

Collections:

a). W. L. Jepson no. 3027, June 17, 1908, Type Specimen (Jepson Herb.). The Type consists of a branch with nine ovulate cones, which are nearly spherical, about 20 mm. in diam., practically without horns or umbos, the surface gray; seeds glaucous, the largest about 5 mm. long. Staminate cones well developed, but not mature, about 3 mm. long, 4-sided, mostly with 10 or 12 scales and showing the yellowish pollen sacs at their margins. Most of the leaves are without visible dorsal glands or pits, but a few have these, of which none appears to be active, although one which was carefully opened (February 21, 1945) was hollow and appeared to have once contained liquid resin. Thus, the Type of *C. Sargentii* is characterized by small, practically hornless ovulate cones with definitely glaucous seeds, and by foliage on which the dorsal glands are mainly lacking, and of the few present none is active. b).

James McMurphy, nos. 568 & 570, July 24, 1909, 591, July 29, 1909, and 671, Aug. 3, 1909, all from "Red Mt. near Ukiah" (all in Dudl. Herb.). No. 591 has very large cones which are very glaucous within. McMurphy also collected several specimens of *C. Macnabiana* at the same times and some which he considered to be hybrids between that species and *C. Sargentii*. However, I regard all his material as referable to one species or the other.

11. Red Mountain, northern Mendocino County. This Red Mountain is located in extreme northern Mendocino County and is reached by turning off the Redwood Highway about 13 miles north of Laytonville. At that point a road leads to Bell Springs. Drive $5\frac{7}{10}$ miles in a northerly direction to the Blue Rock Ranch. About 2 miles above the Blue Rock Ranch, a road leads off to the west to the summit of Red Mountain. A drive of $5\frac{6}{10}$ miles brings one to a flat about one-half mile north of the summit of Red Mountain. However, this road is not maintained, is extremely steep, and it would be better to either walk in or obtain horses at the Blue Rock Ranch.

According to R. W. Cummins, County Surveyor, Mendocino County, in a letter dated February 1, 1945, this "Red Mountain" is located as follows: "The U. S. L. O. township plot for T24N, R16W, M. D. M. shows 'Red Mountain' in the Blue Rock country. This is also shown on Metsker's Map of Mendocino County."

The cypresses on "Red Mountain" are located on the southwestern portion of the mountain at what is, probably, an average elevation of about 3000 ft. They are first reached by hiking about 1 mile southwest from the summit of the mountain. They are scattered over a considerable area of the southwestern slope and are typical of most stations of *C. Sargentii*. Trees a meter or so in height bear ovulate cones, while the largest trees which are about 12 m. high are usually heavily laden. There are many thousands of cypress trees, but they are not thick enough to be called a forest and are scattered over red rock and serpentine in a mixed open forest of *Pinus Lambertiana*, *P. attenuata*, *Libocedrus decurrens*, *Quercus vaccinifolia*, *Garrya buxifolia* and *Arctostaphylos canescens*. These associates mark this as a typical Arid Transition Life Zone, whereas, most of the other stations for *C. Sargentii* are regarded as Upper Sonoran Life Zone.

When I visited Red Mountain in October, 1944, I was under the mistaken impression that I was going to Jepson's "Red Mountain", which, as pointed out above, is southeast of Ukiah in the southern part of the county and is at least 55 miles distant by airline. Between these two stations for *C. Sargentii*, no others are known. Perhaps other botanists have collected *C. Sargentii* on this northern Mendocino County "Red Mountain", but I have not seen their specimens. It is, therefore, possible that my collections on this mountain represent

an extension of the range of the species. At least, they represent the most northerly known station for the species.

Collection:

C. B. Wolf, Coll. No. 11464 (Prop. No. 5038), October 24, 1944. From a tree about 13 m. high, 7 m. spread, and a trunk 5 dm. in diam.

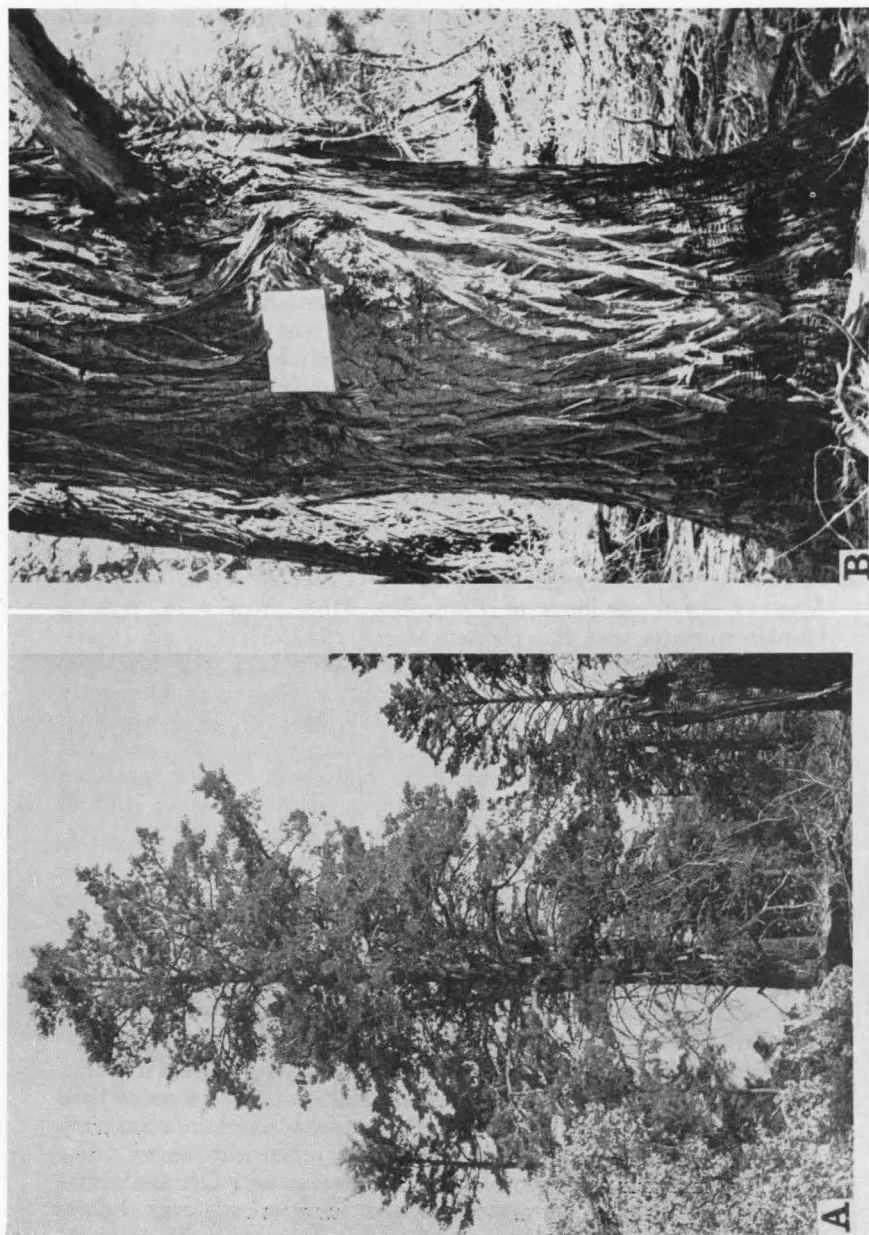
Collections of Cultivated Specimens

a). P. C. Everett, Coll. No. 7794, May 19, 1936, seedlings of Prop. No. 2147, from 4 in. pots in Garden nursery, seed flats planted March and May, 1935; 5 and 6 cm. high, with juvenile spreading leaves; cotyledons still present; root system very well developed. b). P. C. Everett, Coll. No. 7795, May 19, 1936, seedlings of Prop. No. 2151, from 4 in. pots in Garden nursery, seed flats planted March and May, 1935; 5-6 cm. high, with juvenile spreading leaves; cotyledons still present; root system well developed. c). P. C. Everett, Coll. No. 7796, May 19, 1936, seedlings of Prop. No. 2158, from 4 in. pots in Garden nursery, seed flats planted March and May, 1935; 4-6 cm. high, with juvenile spreading leaves; cotyledons still present; root system very well developed, especially in view of the rather small tops. d). P. C. Everett, Coll. No. 7798, May 19, 1936, seedlings of Prop. No. 2168, from 4 in. pots in Garden nursery, seed flat planted March 28, 1935; 12 and 15 cm. high, with juvenile spreading leaves; root system very well developed with numerous fibrous roots. This apparently a vigorous strain in early growth. e). P. C. Everett, Coll. No. 7799, May 19, 1936, seedlings of Prop. No. 2173, from 4 in. pots in Garden nursery, seed flat planted March 28, 1935; 16 and 18 cm. high, with juvenile spreading leaves; root system very well developed with numerous fibrous roots. This apparently a vigorous strain in early growth.

Relationships

Cupressus Sargentii, with the exception of *C. Macnabiana*, is the most widely distributed of the California species. Although it does have a wide distribution and has developed some slight variations, none of these variations is well-marked enough or constant enough to warrant the splitting of the species into subspecies.

Within *C. Sargentii* the bulk of the material is rather uniform, with the trees having leaves of which about one-half or more have visible dorsal pits that are inactive, glaucous seeds and cones varying from nearly globose to irregular due to prominent umbos. The material from Mount Tamalpais, Camp Meeker and Occidental has cones of small size with inconspicuous umbos and only lightly glaucous seeds. These features suggest an affinity with the group of coastal species made up of *C. Abramsiana*, *C. Goveniana*, *C. pygmaea* and *C. macrocarpa*, only the first of which has glaucous seeds in

FIGURE 37. *Cupressus Sargentii*.

some instances. The material from Zaca Peak has considerable variation, but some trees have leaves with active dorsal pits, a feature of constant occurrence in such species as *C. nevadensis* of the interior, but which is not considered to be closely related.

References

CUPRESSUS SARGENTII Jepson, Fl. Calif. 1: 61. 1909, in part, with the exception of the "Bonny Doon, Santa Cruz Mts." locality, which is *C. Abramsiana* Wolf. "Mayacamas Range, W. L. J. No. 3027 (type)." The type specimen which is in the Jepson Herbarium bears the following label: "W. L. Jepson no. 3027, June 17, 1908, Red Mountain, Mayacamas Range, southeastern Mendocino County, c. 3000 ft." 2). Jepson, Silva Calif. 158. 1910, in part, as to the Red Mountain, Mt. Tamalpais, Cedar Mt. and Santa Lucia Mts. localities. 3). Abrams, Ill. Fl. Pac. States 1: 72. 1923. Mt. Tamalpais is given as the type locality, which is an error. 4). Jepson, Man. Fl. Pl. Calif. 58. Sept. 28, 1923, in part, except for the Santa Cruz Mts. locality which is *C. Abramsiana* Wolf. 5). Sarg., Man. Trees No. Am. 2nd ed. 71. Fig. 70. 1926. With the exception of the Santa Cruz Mts. reference, which is *C. Abramsiana* Wolf, Sargent refers the plate in his Silva of North America II: Tab. 527. 1896, to this species, although it was originally published as *C. Goveniana* Gord. 6). Sudw., U.S.D.A. Misc. Circ. 92: 36. 1927, in part, except for the Cedar Canyon locality which is *C. Forbesii* Jepson. Sudworth states that the following varieties are distinguished in cultivation: var. *parva* Sudw., var. *Huberiana* Carr., *glaucofolia* Sudw., *gracilis* (Nelson) Sudw., *cornuta* Sudw., *viridis* (Carr.) Sudw., and *attenuata* (Gord.) Sudw. 7). Van Dersal, Nat. Woody Pl. U.S. 115. 1938. According to this author, there are "seven varieties in cultivation", but I have not been able to verify this statement except as indicated under the preceding reference. 8). McMinn, Ill. Man. Shrubs Calif. 41. Fig. 10. 1939, in part, except for the Santa Cruz Mts., locality which is *C. Abramsiana* Wolf. McMinn's statement "Type locality: Mayacamas Range, Napa County. Collected by Jepson." is by inference only, for Jepson never published any statement that would lead one to believe that his type came from Napa Co. In fact, as here pointed out under Jepson's original reference, the type came from Red Mountain, Mendocino Co.

CUPRESSUS SARGENTII var. *DUTTONII* Jepson, Trees Calif. ed. 2. 200. Sept. 1, 1923. This reference has been listed in the Gray Herbarium card catalogue as the original publication for this variety.

FIGURE 37.

CUPRESSUS SARGENTII—Sargent Cypress.
Cedar Mt., Alameda Co., Calif. Coll. No. 1802 (*Prop. No. 1058*) and Coll. No. 6201 (*Prop. No. 2157*) were collected from this tree in 1930 and 1934.
A—Height about 15 m.; note axe in trunk. Photo Nov. 4, 1930. Neg. No. 230.
B—The thick, furrowed, fibrous bark is characteristic of this species. The white card is 10 x 15 cm. Photo Oct. 19, 1934. Neg. No. 3368.

However, it was not Dr. Jepson's intention to make this the place of publication, and it was only by accident that this book appeared a few days earlier than the portion of his Manual of the Flowering Plants of California where *Duttonii* was designated as a new variety and a type specimen cited. 2). Jepson, Man. Fl. Pl. Calif. 58. Sept. 28, 1923. "(Jepson 7741, type)" is an error, for the original collection which I have seen is Jepson 7441. This was intended by Dr. Jepson to constitute the original place of publication for this variety, but see the discussion given above under the reference to Jepson's Trees Calif. ed. 2. 200. 1923.

CUPRESSUS GOVENIANA Engelm., in Brew. & Wats., Bot. Calif. 2: 114. 1880, in part, at least as to the Marin and Alameda Co. references. "A doubtful form is reported from Cedar Mountain, Alameda County (Dr. Kellogg), described as a handsome tree 30 or 40 feet high, of dense symmetrical growth; the globose cones have 6 very thick scales with stout prominent bosses." This is the plant later described as *C. Sargentii* var. *Duttonii* Jepson. 2). Lemm., West. Am. Conebearers 3rd ed. 76. 1895, in part, at least as to the Mt. Tamalpais locality. 3). Sarg., Silva No. Am. 11: 107. Tab. 527. 1896, in part, and as to Tab. 527, which Sargent later refers to *C. Sargentii* (Man. Trees No. Am. 2nd ed. 71. 1926). 4). Mast., Journ. Linn. Soc. 31: 346. 1896, in part. 5). Jepson, Fl. West. Middle Calif. 25. 1901, in part, at least as to the Mt. Tamalpais and Cedar Mt. localities. 6). Brit. No. Am. Trees 99. 1908, in part. 7). Sudw., For. Trees Pac. Slope 161. 1908, in part, as to the localities listed for Sonoma, Lake, Marin and Alameda Counties; also for the localities in the Santa Lucia Mts., and the San Luis Obispo National Forest. 8). Elwes & Henry, Trees of Great Brit. & Irel. 5: 1171. 1910, in part. *C. Sargentii* Jepson is listed as a synonym, and material from the Mayacamas Range, Mt. Tamalpais, Cedar Mt. and Santa Lucia Mts. is referred to *C. Goveniana*, all of which localities are for *C. Sargentii*. I consider their Plate 299, which is said to be Gowen's Cypress at Dropmore, to be *C. Sargentii*. 9). Camus, Les Cyprès 48. 1914, in part. *C. Sargentii* Jepson is listed as a synonym. 10). Dalli & Jacks., Handb. Conif. 198. 1923, in part. *C. Sargentii* Jepson is listed as a synonym.

CUPRESSUS GOVENIANA var. SARGENTII Elwes & Henry, Trees Great Brit. & Irel. 5: 1173. 1910. (Footnote 5). "While these pages were going finally through the press, I received specimens from Mr. Jepson, which show that the trees of this species growing in Marin County and on Mt. Tamalpais bear larger cones than the type, with large reddish brown glaucous seeds. This form may be called var. *Sargentii*. Mr. Jepson's specimens show various intermediate forms, one at least of which (from Monterey) is very probably a hybrid with *C. macrocarpa*.—(A.H.)" 2). Rehd., in Bailey, Cult. Evergr. 209. 1925.

EXCLUDED SPECIES

In view of the fact that several plants which were early described under *Cupressus* have long been referred to other genera, and also because practically all the species names applied to *Chamaecyparis* (a section or subgenus of *Cupressus* according to some authorities) have been treated as members of the genus *Cupressus*, I do not feel that it is necessary to list them here in detail. However, the following species seems to warrant consideration:

Cupressus thurifera H. B. K., Nov. Gen. et Sp. Pl. 2: 3. 1817. "C. foliis quadrifariam imbricatis; ovato-lanceolatis, acuminato-pungentibus. Cedro incolarum. Crescit in sylvis Regni mexicani prope Tasco et Tehuilotepac, alt. 920 hexap. Fructificate aprili."

This species has long been misunderstood, and for many years material obtained from Mexico, which in this paper is referred to *C. lusitanica* Mill., was referred to it. Endlicher (Syn. Conif. 62. 1847) referred it to *Chamaecyparis*. Masters (Journ. Linn. Soc. 31: 349. 1896) recognized *Cupressus thurifera* H. B. K., and in discussing the species says: "The cones collected by Botteri, just alluded to, have in the dry state, their scales so widely separate that the cones resemble those of *Tetraclinis articulata*, and their peltate form is scarcely apparent. If, however, the cones be soaked in water so as to restore the original form, a resemblance to Humboldt's *thurifera* becomes visible." Elwes and Henry (Trees Great Brit. & Irel. 5: 1150. 1910) regarded *Cupressus* as including also *Chamaecyparis*. In speaking of *C. thurifera* H. B. K., they said: "A rare species recorded for three or four localities in Mexico and doubtfully referable to *Cupressus*." Camus (Les Cypres 91. 1914) said that the specimens she had seen were insufficient to determine with certainty (liberal translation from her French). Standley (Contrib. U. S. Nat. Herb. 23: 62. 1920) in his Trees and Shrubs of Mexico recognized *C. thurifera* H. B. K. as follows: "Seeds not winged, 2 or 3 to each scale; leaves not appressed. Vera Cruz and Oaxaca; type from Tasco and Tehuilotepac, at 1,750 meters. Shrub or large tree. 'Cedro' (Veracruz); 'cedro de la sierra' (Durango, Veracruz, etc.); 'ciprés' (Veracruz); 'cedro amarillo', 'gretado amarillo' (Oaxaca, Reko); 'tlatzán' (Herrera)."

My own conclusion regarding *C. thurifera* H. B. K. is that its identity is still uncertain, and that lacking either opportunity to examine the original material or specimens which have been referred to it by the authors mentioned above, I am excluding it from the genus *Cupressus*.

ALPHABETICAL LIST OF SPECIES AND SUBSPECIES OF NEW
WORLD *Cupressus* WITH THEIR PRINCIPAL SYNONYMS.

CUPRESSUS ABRAMSIANA C. B. Wolf (1948)

Cupressus Goveniana, of various authors, in part, not Gord.
(1849).

C. Sargentii Jepson (1909), in part; also various authors, in
part.

CUPRESSUS ARIZONICA Greene (1882)

Cupressus guadalupensis Sarg. (1890), not S. Wats. (1879).

C. arizonica var. *bonita* Lemm. (1895).

C. Bentharii var. *arizonica* Mast. (1896).

C. glabra Sudw. (1927) in part, not Sudw. (1910).

CUPRESSUS BAKERI Jepson (1909)

Includes: *Cupressus Bakeri* subsp. *Matthewsii* C. B. Wolf
(1948), and subsp. *typica* C. B. Wolf (1948).

CUPRESSUS BAKERI subsp. MATTHEWSII C. B. Wolf (1948)

Cupressus Bakeri, of various authors, in part, not Jepson (1909).

C. Macnabiana, of various authors, in part, not Murr. (1855).

CUPRESSUS BAKERI subsp. TYPICA C. B. Wolf (1948)

Cupressus Bakeri Jepson (1909).

C. Macnabiana var. *Bakeri* Jepson (1923).

C. Macnabiana, of various authors, in part, not Murr. (1855).

CUPRESSUS FORBESII Jepson (1922)

Cupressus Goveniana, of various authors, in part, not Gord.
(1849).

C. guadalupensis, of various authors, in part, not S. Wats.
(1879).

C. macrocarpa Mast. (1896), in part, not Hartw. (1847).

C. Sargentii, of various authors, in part, not Jepson (1909).

CUPRESSUS GLABRA Sudw. (1910)

Cupressus arizonica, of various authors, in part, not Greene
(1882).

C. arizonica var. *bonita*, of various authors, in part, not Lemm.
(1895).

— — — — — var. *glauca* Woodall.

CUPRESSUS GOVENIANA Gord. (1849)

Cupressus californica Carr. (1855).

C. cornuta Carr. (1866).

C. Goveniana var. *attenuata* Carr. (1867).

— — — — — var. *pendula* Elwes & Henry (1910).

— — — — — var. *viridis* Carr. (1867).

CUPRESSUS GUADALUPENSIS S. Wats. (1879)

Cupressus macrocarpa var. *guadalupensis* Mast. (1895).

CUPRESSUS LUSITANICA Mill. (1768)

- Cupressus aromatica* Van Houtte ex Gord. (1858).
C. Bentharii Endl. (1847).
C. Bentharii var. *Knightiana* Mast. (1896).
 ————— var. *Lindellii* Mast. (1896).
C. Coulterii Forbes (1839).
C. elegans Hort. (probably Carr., 1855).
C. Ehrenbergii Kunze (1847).
C. excelsa Scott ex. Gord. (1858).
C. glauca Lamarck (1786), also Forbes (1839).
C. kewensis Hort. (probably Mast., 1896).
C. Karwinskyana Regel (1857).
C. Knightiana Knight & Perry (1850), also Perry (1858).
C. Lindleyi Klotzsch ex Endl. (1847).
C. lusitanica var. *Bentharii* Carr. (1867).
 ————— var. *glauca* Elwes & Henry (1910).
 ————— var. *Knightiana* Rehd. (1919).
 ————— var. *Uhdeana* Carr. (1867).
C. lusitanica patula Mill. (1768).
C. lusitanica var. *Skinneri* Elwes & Henry (1910).
C. mexicana Koch (1873).
C. mexicana glauca Koch (1873).
C. pendula L'Herit. (1784).
C. sinensis Lee ex. Gord. (1858).
C. sinensis pendula Hort. (probably Carr., 1855).
C. Skinneri Hort. (probably Scott ex. Gord., 1858).
C. tetragona Hort. (probably Carr., 1855).
C. thurifera Benth. (1848), also Hort., also Lindl. (1839), also Schlecht. (1838), but not H. B. K. (1817).
C. thurifera elegans Hort. (probably Perry ex. Gord., 1858).
C. thurifera Knightiana Gord. (1858).
C. Uhdeana Gord. (1850), also Hort. (Carr., 1855).

CUPRESSUS MACNABIANA Murr. (1855)

- Cupressus attenuata* Gord. (1858).
C. Bourgeauii Hort. (probably Gord., 1875).
C. californica gracilis Senilis (1866).
C. Coulterii Hort., Glasnevin (probably Mast., 1896), not Forbes (1839).
C. glandulosa Hook. (1858), (possibly Henk. & Hochst., 1865).
C. Macnabiana var. *sulphurea* Berckmans (1915).
C. nabiana Mast. (1896).
C. nivea Hort. (probably Gord., 1858).
Juniperus Macnabiana Laws. (1858).

CUPRESSUS MACROCARPA Hartw. (1847)

- Cupressus Hartwegii* Carr. (1855).
C. Hartwegii var. *fastigiata* Carr. (1867).

- C. Lambertiana* Hort. (Gord., 1849).
C. Lambertiana var. *fastigiata* Carr. (1855).
C. macrocarpa var. *angulata* Lemaire (1868), also Lemm. (1902).
 ————— var. *Crippsii* R. Smith (1874), also Gord. (1875).
 ————— var. *farallonensis* Mast. (1896).
 ————— var. *fastigiata* Knight (1850).
 ————— var. *flagelliformis* Cripps (probably Dalli. & Jacks., 1923).
 ————— var. *Lambertiana* Hort. (Mast., 1896).
 ————— var. *lutea* Kent (1900).
 ————— var. *variegata* Nelson [Senilis] (1866).
C. macrocarpa *foliis variegatis* Lemaire (1868).
C. macrocarpa forma *pygmaea* A. B. Jacks. (1938).
C. Reinwardtii Hort. ex Beissn. (1891)
- CUPRESSUS MONTANA Wiggins (1933)
Cupressus arizonica Standl. (1920), in part, not Greene (1882).
C. guadalupensis, of various authors, in part, not S. Wats. (1879).
- CUPRESSUS NEVADENSIS Abrams (1919)
Cupressus Macnabiana, of various authors, in part, not Murr. (1855).
C. Macnabiana nevadensis Abrams (1923).
- CUPRESSUS PYGMAEA (Lemm.) Sarg. (1901)
Cupressus Goveniana, of various authors, in part, not Gord. (1849).
C. Goveniana var. *parva* Lemm. (1902).
 ————— var. *pigma* Lemm. (1895).
- CUPRESSUS SARGENTII Jepson (1909)
Cupressus Goveniana, of various authors, in part, not Gord. (1849).
C. Goveniana var. *Sargentii* Henry (1910).
C. Sargentii var. *Duttonii* Jepson (1923).
- CUPRESSUS STEPHENSONII C. B. Wolf (1948)
Cupressus Forbesii C. B. Wolf (1938), in part, not Jepson (1922).